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Contents

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

XIXth International Physiological Congress

MONTREAL will receive an important gathering of scientists when the XIXth International Physiological Congress convenes there from August 31 to September 4, 1953, bringing together workers in the fields of physiology, pharmacology, biochemistry, and allied medical sciences. The invitation to meet in Canada was issued by the Canadian Physiological Society, and accepted at the eighteenth congress held in Copenhagen in 1950. The decision recognized outstanding achievements of Canadian investigators in recent years. Montreal was chosen because of its two institutions of higher learning, McGill University and the Université de Montréal.

The international body responsible for the organization of the physiological congresses held the first meeting in Basle, Switzerland, in 1889, under the presidency of Professor F. Miescher. Members in attendence numbered 123, from 13 countries; six came from North America. The meeting attracted a group of outstanding students of that day, including Bowditch, Ewald, Fredericq, Gad, Goltz, Heidenhain, Hermann, His, Horsley, Hürthle, Jacquet, Kronecker, Langley, Langlois, Lombard, Minkowski, Mosso, von Frey, von Kries, and Waller. This distinguished group gave strong support to the organization, which from then on held meetings every three years, with steadily increasing attendance, except when prevented by the two world wars. Congresses convened in Liége (1892), Berne (1895), Cambridge (1898), Turin (1901), Brussels (1904), Heidelberg (1907), Vienna (1910), Gröningen (1913), Paris (1920), Edinburgh (1923), Stockholm (1926), Boston (1929), Rome (1932), Moscow (1935), Zurich (1938), Oxford (1947), and Copenhagen (1950).

Registrations for the coming Congress have reached 1700, from 40 countries. Two-thirds of the members will come from the western hemisphere, chiefly from Canada and the U.S.A. Argentina, Brazil, Chile, Colombia, Cuba, Equador, Mexico, and Venezuela will all be represented. About 400 members are coming from Europe, with substantial groups from Austria, Belgium, France, Germany, Italy, the Netherlands, the Scandinavian countries, Spain, Switzerland, the United Kingdom, the U.S.S.R., and Yugoslavia. Poland and Czechoslovakia will also be represented. From the Near and Far East will come members from Australia, China, Egypt, Indonesia, India, Iraq, Israel, Japan, Korea, Lebanon, and New Zealand. This broad distribution ensures a significant international meeting.

From a fund raised largely in Canada and the U.S.A., 162 scientists from 34 countries are receiving travel grants. The distribution of money has been made on the recommendation of the appropriate national scientific societies.

The scientific program will be divided into two parts. Fifteen programs on special topics will proceed in lecture rooms at McGill University. Concurrently, seven symposium sessions will be held at the Université de Montréal: Physiological Theories of Learning (K. S. Lashley, U.S.A., Chairman); Hemodynamics in Small Vessels (B. Folkow, Sweden, Chairman); Physiology of Cold (E. F. Dubois, U.S.A., Chairman); Mechanism of Formation of the Thyroid Hormone (J. Roche, France, Chairman); Metabolic Influence of Insulin (B. A. Houssay, Argentina, Chairman); Postural Mechanisms (F. Bremer, Belgium, Chairman); Reflexes from the Cardiac and Pulmonary Areas (C. F. Schmidt, U.S.A., Chairman).

The International Council of Scientific Unions has organized a symposium to be held at the time of the Congress, which will be open to its members, entitled "Future and Limitations of Physiological Research," under the chairmanship of Professor E. D. Adrian of Cambridge, England.

Dr. C. H. Best, Professor of Physiology in the University of Toronto, is chairman of the International Congress Committee and has been elected to serve as President of the Congress. He is well known for his share in the discovery of insulin and for his dietary studies. Dr. F. C. MacIntosh is chairman of the local organizing committee, Dr. E. Robillard is secretary, and Dr. W. F. Denstedt is treasurer.

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Boston, Mass., December 26-31, 1953

The list of hotels and their rates and the reservation coupon below are for your convenience in making your hotel room reservation in Boston. Please send your application, *not* to any hotel directly, but to the AAAS Housing Bureau in Boston and thereby avoid delay and confusion. The experienced Housing Bureau will make assignments promptly; a confirmation will be sent you in two weeks or less. **Share a room with a colleague if you wish to keep down expenses.** Mail your application *now* to secure your first choice of desired accommodations. All requests for reservations must give a definite date and estimated hour of arrival, and also probable date of departure.

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Oöcyst-Like Bodies on the Midgut of *Stilbometopa impressa* (Bigot) (Diptera: Hippoboscidae)

I. Barry Tarshis[1, 2]

Division of Entomology and Parasitology, University of California, Berkeley

DURING the past several years investigative work has been in progress on the fly-bite transmission of *Haemoproteus lophortyx* (O'Roke) by the quail louse fly, *Stilbometopa impressa* (Bigot). Although *S. impressa* has been found to be a vector of *H. lophortyx* by fly-bite transmission (*1*), an exhaustive search for the oöcysts on the midguts of the flies has proved futile. The presence, however, of peculiar, oöcyst-like nodules on the midguts of *S. impressa* has been revealed (Figs. 1–3).

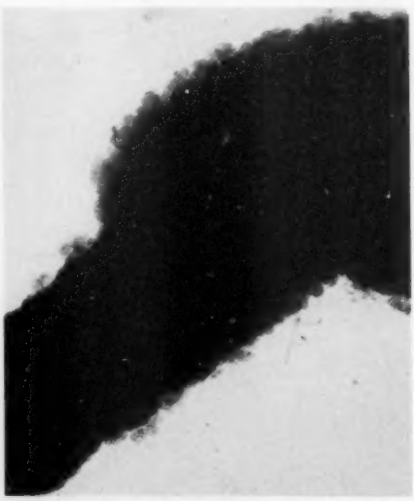

FIG. 1. The midgut of an unfed *S. impressa* (Bigot) showing nodules. × 50.

The oöcyst-like nodules are so similar in appearance to the oöcysts of the Plasmodiidae that one might be tempted to regard them as oöcysts of *H. lophortyx* were it not for the fact that they appeared in more than 85% of the dissected flies, regardless of the age, sex, and other conditions of the flies. This, plus additional evidence presented below, makes it seem more reasonable to interpret these nodules as a new type of mycetome containing symbiotes.

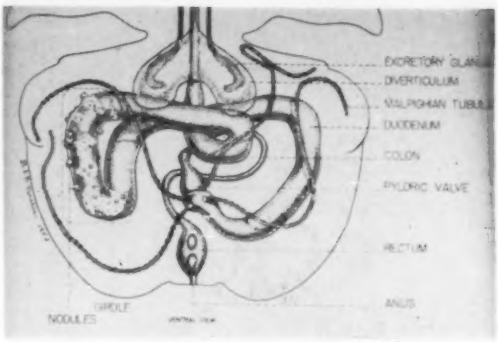

FIG. 2. Drawing of the midgut of *S. impressa* (Bigot) showing location of nodules and opaque white patches.

The oöcyst-like nodules were first discovered about 2 yr ago on the midguts of flies fed on *Haemoproteus*-positive Valley California Quail, *Lophortyx californica californica* (Shaw and Nodder). Subsequent search for these nodules revealed that flies newly emerged from their pupal cases and flies fed on *Haemoproteus*-negative quail also have nodules on the midguts. Newly emerged flies that have not had a blood meal generally have many more nodules than flies that have engorged several times.

Closer examination shows that the nodules are not directly attached to the normal midgut wall, but to heavy, opaque white, irregular patches which girdle the widened, sausage-shaped portion of the midgut (Figs. 2, 3). The location of these opaque white patches and the nodules is unvarying. The nodules are actually outcroppings of the patches and often appear as buds projecting from them (Fig. 4). As the gut is rolled over successive groups of various sized nodules can be observed.

A total of 193 freshly killed flies of both sexes of *S. impressa* were dissected and though 19 midguts were found devoid of all nodular bodies the opaque white patches were present in all 193 flies. The midguts without the nodules were found in flies taken from trapped quail and from flies that had lived on laboratory quail for several months. The remaining

[1] Predoctorate Research Fellow, National Institutes of Health.

[2] This work has been done under the direction of M. A. Stewart whose supervision and help is deeply appreciated. The writer is also grateful to Edward Steinhaus and Kenneth Hughes of the Department of Biological Control, University of California, and to Joseph Bequaert of the Museum of Comparative Zoology, Harvard University, for their aid and many helpful suggestions in regard to this problem.

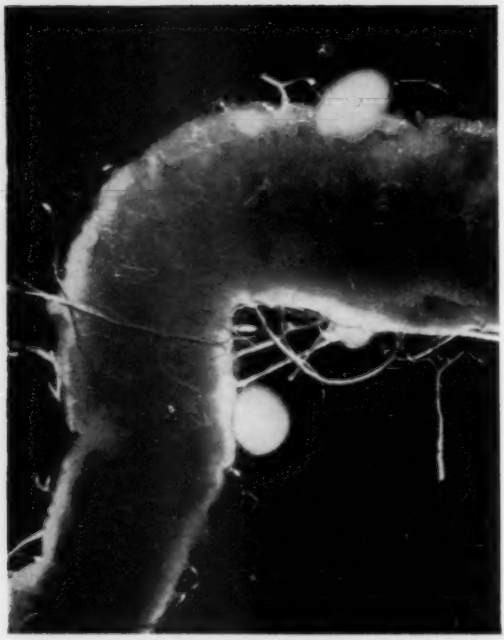

FIG. 3. The midgut of a fed *S. impressa* (Bigot) showing nodules of varying sizes. × 55.

174 midguts examined showed nodules of varying numbers and dimensions. These latter midguts were found in flies taken from trapped quail, laboratory reared flies fed on both infected and noninfected quail, and newly emerged unfed flies (Table 1).

The nodules are subglobular to spherical in shape and vary in size from 3.28 to 217.6 microns at the greatest diameter. The nodules occur singly and in groups of two or more. They are opaque white with sharply defined outlines and their contents are densely granular. The unbroken nodules appear to be filled

FIG. 4. The midgut of an unfed *S. impressa* (Bigot) showing opaque white, irregular patches. Note nodules projecting from patches. × 55.

TABLE 1

TABULATION OF *Stilbometopa impressa* (BIGOT) DISSECTED AND FOUND TO HAVE NODULES ON THE MIDGUTS

Number of fed flies found to have nodules on midguts				Number of flies taken from trapped quail found to have nodules on midguts		Number of newly emerged flies, not having had a blood meal, found to have nodules on midguts	
Fed flies from infected quail		Fed flies from non-infected quail		From infected and non-infected quail			
♂	♀	♂	♀	♂	♀	♂	♀
36	30	13	12	14	16	25	28

with roundish particles. When the nodules are broken, fine sandlike masses can be seen flowing from them

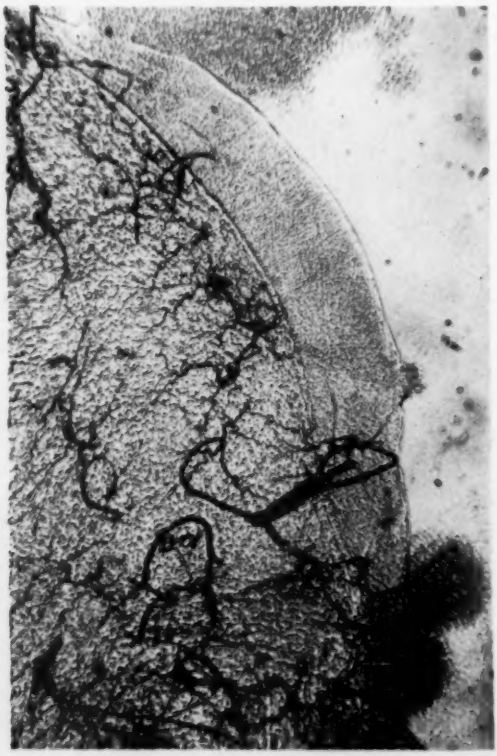

FIG. 5. An enlarged portion of the midgut of *S. impressa* (Bigot) showing a portion of a large opaque patch (the narrow granular band) attached to the midgut. Note the two nodules (bottom, center) attached to the opaque patch. The granular mass (top, center) is a large group of microorganisms escaping from the perforated edge of the patch. × 90.

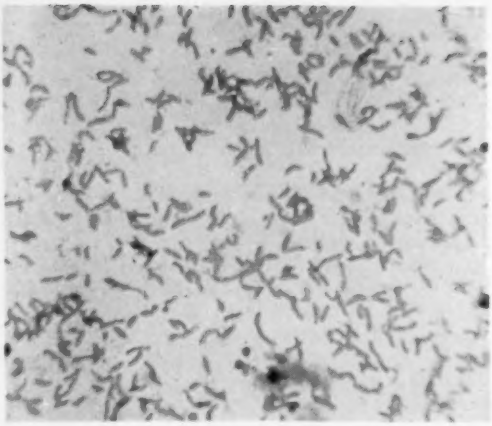

FIG. 6. A mass of stained microorganisms obtained from a nodule on the midgut of an unfed *S. impressa* (Bigot). × 1200.

(Fig. 5). This can be observed under the low and high dry objectives of the compound microscope.

The granular content of the nodules is revealed as a multitude of individual rod- or sausage-shaped structures which appear to be analogous to certain Gram-negative, bacteriumlike microorganisms found in some species of *Glossina* and in such Pupipara as *Lipoptena, Hippobosca, Ornithomyia,* and *Nycteribia* (*1–4, 14*). The microorganisms of *S. impressa* have a length of from 3.49 to 4.62 microns and a width of from 0.66 to 0.99 micron. The rod- or sausage-shaped microorganisms occur singly, in pairs, and in chains (Figs. 6–8). In the chained arrangement they sometimes form an S or Y.

All the microorganisms from within the nodules and the opaque white patches have been identical in appearance, size, and shape. The age, sex, and other conditions of the fly seem to cause no variation in the microorganisms. They are the same whether taken from the midguts of newly emerged flies that have not had a blood meal, from flies having fed for a period of several weeks to months on *Haemoproteus*-positive quail, or from flies fed for varying time periods on *Haemoproteus*-negative quail.

The microorganisms within the nodules and opaque white patches on the midguts of *S. impressa* can be stained with either Giemsa's or Gram's stain and are Gram-negative.

Attempts to grow these organisms on Locke-semi-solid, Noeller-blood agar, and peptone-gelatin blood media were unsuccessful.

Serial sections of the midguts of *S. impressa* containing the nodular masses are being prepared for study at a later date.

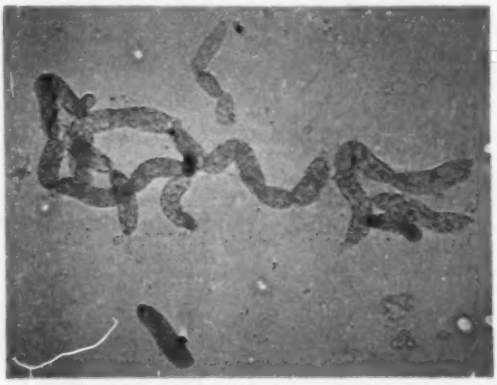

FIG. 7. Electron micrograph of microorganisms taken from nodules on midgut of an unfed *S. impressa* (Bigot). × 5320.

It has been reported in the literature that symbiotes of other Pupipara were found on the anterior portions of the midguts where the epithelium had become so developed as to form definite whitish collars or rings

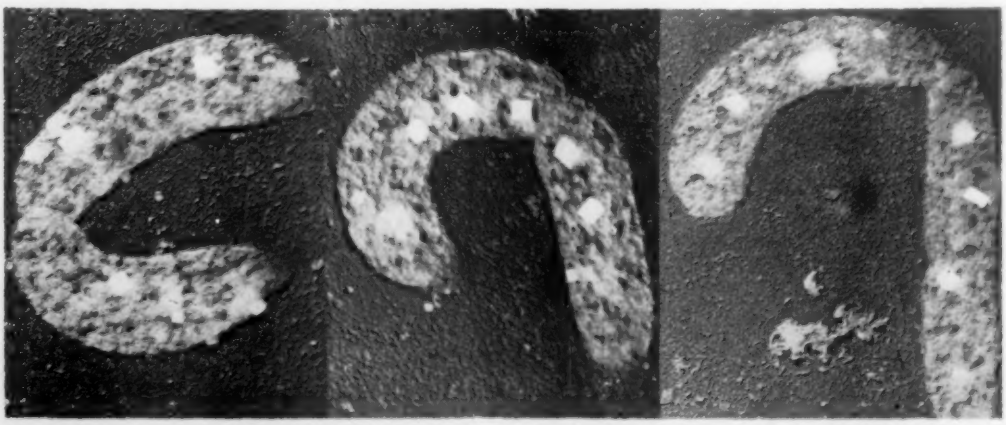

FIG. 8. Electron micrographs of individual microorganisms taken from nodule on the midgut of an unfed *S. impressa* (Bigot). The white spots are saline crystals. × 15,500.

(the mycetomes). There seems to be enough similarity between the opaque white patches found on the midguts of *S. impressa* and the ringlike mycetomes found on the midguts of other Pupipara to conclude that they are essentially the same. The writer, however, has not been able to find descriptions in the literature of any symbiote-filled nodular bodies such as he has been able to find budding off the opaque white patches on the midguts of *S. impressa* as shown in Figs. 3 and 4.

Recent investigative work on the biology of *Ornithomyia fringillina* (Curtis) and *Ornithoica vicina* (Walker), Hippoboscidae of the white crowned sparrow (*5*), has revealed nodular bodies on the midguts of these flies which appear to be similar to those of *S. impressa*. The nodules have also been found to contain microorganisms analogous to those found in the nodules of *S. impressa*.

The Sergents (*6*) demonstrated experimentally the transmission of *Haemoproteus columbae* Kruse of the domestic pigeon by the bite of *Pseudolynchia canariensis* (Macquart). Adie (*7, 8*) later described as oöcysts of *H. columbae* nodular projections which she found on the midgut of *P. canariensis* on the 4th day after the fly had an infective blood meal. The young cysts measured from 7.2 to 8.2 microns. She further stated that the mature cysts were approximately 36 microns in diameter and that they were filled with pigment. She described the pigment as consisting of "roundish (not rod-shaped), particles." As stated above, the microorganisms seen within the nodules on the midguts of *S. impressa* also appear roundish in the intact nodules. However, once they escape from the broken or ruptured nodules they assume the rod- or sausage-shaped form as shown in Fig. 6.

O'Roke (*9*) incriminated *Lynchia hirsuta* (Ferris) as a vector of *H. lophortyx* by finding what he regarded as oöcysts on the midguts of flies taken from infected quail. The present author has been unable to find either oöcysts or nodules, such as he has found in *S. impressa*, on the midguts of a large number of *L. hirsuta* dissected.

Kadner (*10*) incriminated *S. impressa* as a natural vector of quail malaria when he found 10–15 well-defined supposed oöcysts on the midgut of one fly. Since the present author has found nodules on the midguts of more than 85% of the *S. impressa* he has dissected, the question comes to mind, "Were the oöcysts found by Kadner identical to the nodules described in this paper?"

Kartman (*11*) states that he found what he interprets as oöcysts of *H. columbae* on the midguts of 9 *P. canariensis* taken from pigeons in Hawaii. In his paper, Fig. 3 on the bottom of page 131, two photographs of oöcysts taken from *P. canariensis* are shown. It is interesting to note the great similarity of these oöcysts to the nodular bodies found in *S. impressa* as described and pictured in this paper.

Lastra-Galler (*12*) and Coatney (*13*), while working with *P. canariensis* as a vector of *H. columbae*, were unable to find any oöcysts on the dissected and sectioned midguts of these flies.

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Manuscript received November 12, 1952.

Microorganisms or Mitochondria?

Jaroslav Peklo

Prague XII, Chodska 3II, Czechoslovakia

UNDER THE TITLE "Observations on the Supposed Symbiotic Microorganisms of Aphids" (Science, **115**, 459 [1952]), U. N. Lanham has expressed the curious opinion that the particles contained in the mycetomes of aphids are not symbiotic bacteria but cell particulates. His paper was criticized by Trager (Science, **116**, 332 [1952]) in a communication entitled "Mitochondria or Microorganisms?" to which Lanham replied in the same number of Science. He pointed out with respect to the particles in question, ". . . the hypothesis that they are symbiotic microorganisms seems to be a more unlikely, difficult, and complex one than the hypothesis that they are intracellular particulates of the nature of mitochondria." And Lanham added: "The aphid particles are said to have been grown *in vitro*. All such claims need verification. Some reportedly successful experiments involve very simple techniques and can easily be repeated. My own attempts to cultivate them, including the use of hanging drop tech-

niques where individual particles could be observed, were not successful." In this incident, Lanham sees another proof of his idea that mycetome inhabitants of aphids are mitochondria. In the following article I accept Lanham's imperative appeal for the verification and ask for permission again to report my own results on the same matter, published in 1916 (*1*) in the Czech language (*2, 3*).

Plate I, 3 represents a cross section through a part of the body of *Phylloxera vastatrix* Pl. (Chermesini), which lives on the root nodules of grapevines. Around the eggs (one of them has fallen out) there is a wreath of mycetocytes, to the number of 5 or 9 respectively, containing Lanham's particles (300 ×). They were fixed according to Juel and are to a large extent poorly stained (iron-alum 24 hr, Heidenhain 24 hr; counterstained with aniline-safranin) because their protein contents had already been for the most part consumed and exhausted (by the eggs?). On the other hand, in the adjacent egg, the yeast *Torula* (*Torulopsis, Cryptococcus,* or *Sulcia*) can be seen. I suggest the name *Sulcia* owing to many cases of the identical, but very variable organisms (in my opinion not belonging to Saccharomyces) described by Šulc in his papers on Homoptera (*Ptyelus,* [*4*]; *Oliarius,* Fulgoridae; *Margarodes,* [*5*], Coccidae, [*6*]), and which I have described and isolated in numerous samples from the fat body in the larvae of different insects (*7–11*). Tóth (*12,* Fig. 12) has also pictured a ring of mycetocytes, probably not exhausted, around one egg of *Pemphigus* showing deeply stained organisms (*Sulcia*). By contrast, in the same figure, the mycetocyte particles are only faintly stained. Nevertheless, they fill the whole space of the mycetocytes and clearly reveal their bacterial form. In the above-mentioned preparation of the mycetocytes of *Phylloxera* there are, apart from remaining particles, bacterial cells with protein contents, and numerous more or less empty hypertrophied cells reminiscent of the bacteroids of the Leguminosae; nevertheless, they are by no means so clearly differentiated as the former. The normal particles measure 1.8 μ. On the other hand, in the mycetocytes (Plate II, 4) and embryos (Plate II, 5) of *Schizoneura lanigera* H. the inclusions are much larger, 2.7–3.6 μ, and they entirely fill the cell. Also, Plate I, 1, representing an embryo of *Schizoneura lanigera,* and Plate I, 2, which shows the mass of symbiotes squeezed out from a young insect should be noted. Were these mitochondria, their size would surely be astonishing! They also were fixed according to Juel, strongly stained with Heidenhain's safranin and, in the same egg, were slowly but abundantly dissolved and digested. Likewise, in samples of *Lecanium persicae* from peaches and plums, I found very small mycetomes filled with extremely fine particles (bacteria), very weakly stained in contrast to numerous black sulciae round about, and in other places black, long-shaped, yeast-like sybiotes. Paillot (*13*) stained, after Giemsa, "microorganismes symbiotiques," prepared from the aphid bodies ("de frottis de Puceron dilaceré"), including the mycetomes of *Schizon. lanigera,* of *Tetraneura ulmi, Macrosiphum tanaceti,* the black aphid of plantain, *Aphis atriplicis, Macrosiphum jaceae, Aphis rumicis, Chaetophorus aceris,*

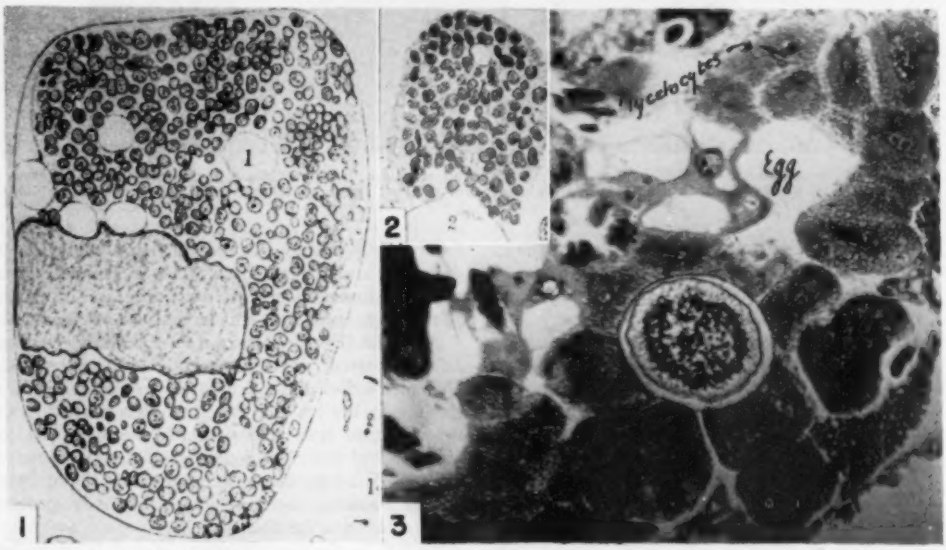

PLATE I. 1. An embryo of *Schizoneura lanigera* H. sketched *in vivo*; filled with large bacterial symbiotes (400 ×). 2. A mass of symbiotes squeezed out from a young *Schizoneura* (400 ×). 3. A cross section through *Phylloxera vastatrix* Pl. living on a root nodule of grapevine (300 ×). Around the eggs are the mycetocytes. An egg has fallen out during the preparation; another one contains numerous torulae (sulciae), stained deep black (Heidenhain). The mycetocytes are almost colorless.

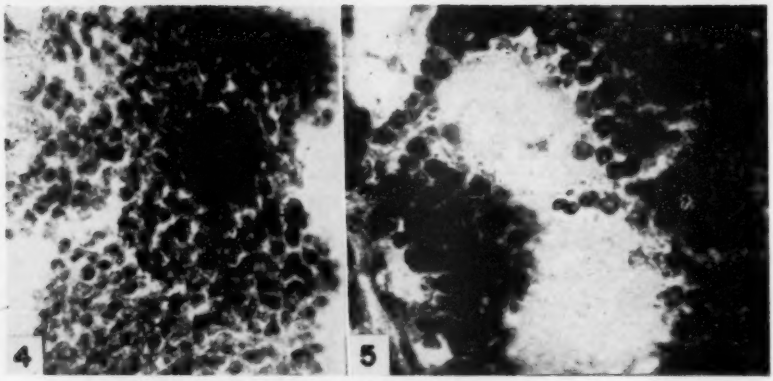

PLATE II. 4. A mycetocyte of *Schizoneura* Heidenhain-aniline-safranin; in the middle a nucleus (830 ×). 5. A cross section through an egg of *Schizoneura*. Heidenhain-aniline-safranin (830 ×). Large symbiotes, giant cocci; in the middle, they are digested.

C. lyropictus, Aphis forbesi, and *Rhopalosiphum ribis.* In general, the form of the bodies was that of our well-known globular particles. Consequently, when Lanham asserts: "It should be noted, however, that when techniques are available which bear critically on the problem, such as the acid-Giemsa technique, the evidence from staining is, at least so far, negative," Paillot's results show just the contrary. With regard to the question to nuclei in the particles: in my inclusions of *Schizoneura,* though they were well-stained and differentiated, the nuclei are not discernible (Plate II, 5). But in another preparation taken from the same insect there appears, in addition to the bacterial symbiotic nests, an egg with the symbiotes of a similar form, also well-stained, but digested in the form of large plasma masses in which some cells of the endophyte remain, showing red nuclei: the fungus *Sulcia,* in contrast to the previously mentioned bacteria. A glance at the pictures by Paillot (*13*), pp. 336, 358, 361, 362, 364, 365, 366, 373, 374—"coupes de myceto"—and by Buchner (*14*), pp. 460, 475, 481, 483, 487, and others, reveals that in the mycetocytes of these insects more or less large cocci or short, plump rods occur, much as in the case of *Azotobacter.*

As to the direct infection of eggs with the symbiotes, Lanham denies it. And in this respect he recalls Uichanco's descriptions. But these are incorrect, according to Paillot and Buchner. Nevertheless, it suffices, e.g., to look at Fig. 11 (*Pemphigus filaginis*; hinterer Pol des Wintereis, Symbioten Invasion) of Tóth (*15*), where one clearly sees how the symbiotes (small globules, bacteria) in great masses penetrate an egg between the follicle cells.

Also ". . . jumbling together of unrelated evidence from diverse groups of insects," disregarded by Lanham, can be worth while. Thus in *Doryphora decemlineata* L., I have distinctly stained, after Heidenhain, the masses of small sulciae occupying young cells of the fat body. Later on, in the older ones, they are larger, swollen, faintly stained, and digested. Bac-

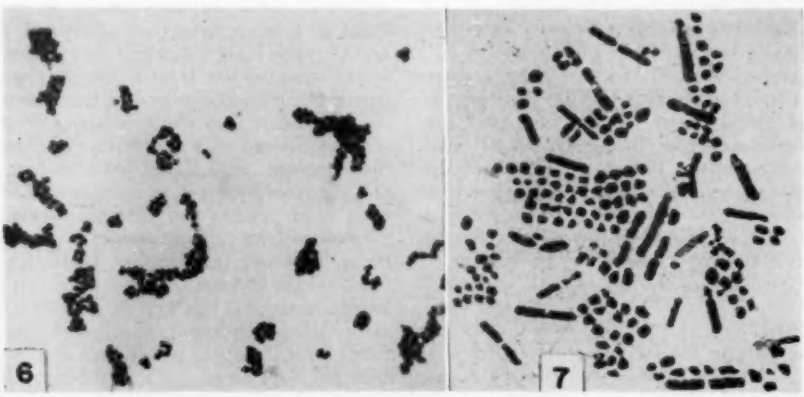

PLATE III. Isolates from *Schizoneura,* the same strain. 6. *Phascolus* + sucrose-agar, pure culture 14 days old. Karbolfuchsin-Král 20 min. The cocci are very small (800 ×). 7. *Phascolus* + sucrose solution, 24 hr old. Löhnis-Victoria blue, Gram. Cocci and rods (100 ×).

terial masses in the fat body of young larvae of *Apis mellifica* L. were stained with Heidenhain's tannin-strong aniline-safranin. After digestion, their remnants appear blue with Giemsa. In the gut of the same larvae there are localized great masses of large bacteria, stained a pink rose with Giemsa, and in digested masses. In the nuclei of caterpillars of *Lymantria monacha* L. I am able to differentiate with Giemsa the chromatin (red) from the very small sulciae (blue), on their way to digestion, and so on. The Feulgen reaction is convenient for the investigation of more important phenomena than are Lanham's mycetome particles. To sum up: Lanham's assumption, that on his inability to stain mycetome particles in some stages of development disproves their bacterial nature, is not worth considering.

In 1914, I started my cultivation experiments with an aphid that lives on the leaves of *Acer platanoides*. The following culture media were used: bouillon or white bean decoction + 6% sucrose (this disaccharide is produced in great quantities in the leaves of maples), mostly diluted + $CaCO_3$; tap water + sucrose + tricalcium phosphate; tap water + glycogen; asparagine. Turbidities soon appeared in the liquid media; on agar there were films white, yellow, pink, dry, slimy, tough, scabby pellicles. There were isolated 50 strains from the same species of the aphid. The trials, of course, took time. Also, Tóth (*16*) speaks of the "mühevolle Arbeit mit der Isolation der Aphidensymbionten." Unfortunately, he gives only superficial descriptions of his cultures, and without any bacterial morphology. My own pure cultures consisted of very small cocci. Very often they showed great variability. Thus, there appeared among the cocci short rods passing into cocci; mostly in young cultures, which by repeated plating, were revealed to be entirely pure. In other cases there were found more or less regular sarcinae (better termed: morulae). All combinations of these forms occurred. For example, in glycogen + sucrose + water a coccus produced small, oval, monociliate, motile cells, and, later on, sarcine clusters. Occurrences of short or longer rods in coccus cultures were regular features in the pure cultures. By careful examination, strains consisting both of cocci-rods and sarcine-like clusters were repeatedly discovered; on agar, the latter produced even large—I might say, giant—cocci, in big, slimy packets—as they are described in the *Azotobacteriaceae*. *Phylloxera* (30° C), tap water + sucrose + glycogen, bouillon, offered similar isolates. When young larvae of *Lecanium persicae*, especially in bouillon + 1% amygdalin, were used, there appeared a small coccus, with later discovered minute mycetomes. Since these studies were tiresome, they were later on replaced with large, pregnant bodies of *Schizoneura lanigera*. After sterilization of the insects with alcohol and flame, the bodies were sucked out with very fine capillaries; or by means of extremely careful pricking and subsequent squeezing, the isolation mass was limited to the smallest possible area and crushed between splinters of cover glasses in the solutions or placed on agar dabbed with distilled

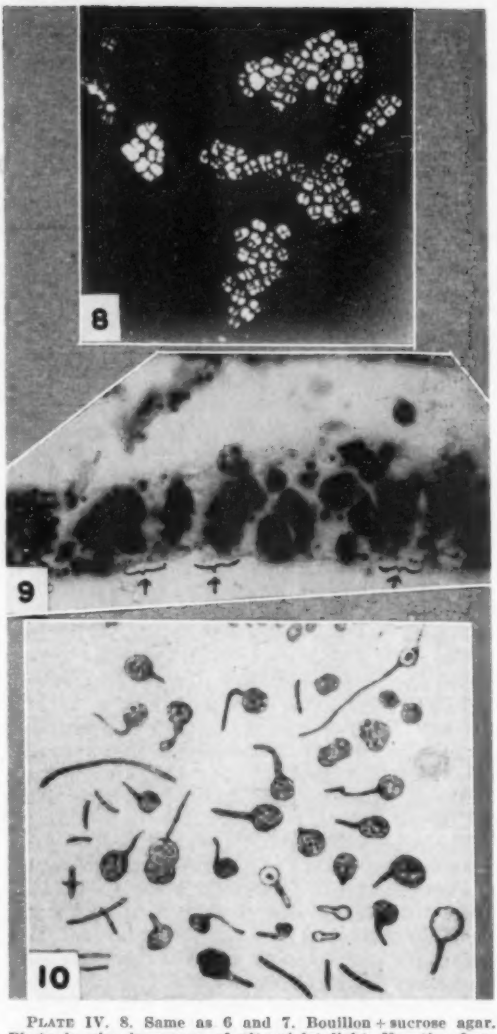

PLATE IV. 8. Same as 6 and 7. Bouillon + sucrose agar. Photo *in vivo* by means of ultraviolet light. Negative from a diapositive. Sarcinae-clusters (500 ×). 9. A longitudinal section through mycetome from a very young caterpillar of *Lymantria monacha* L. Heidenhain. Large hypertrophies of the symbiotic *Sulcia* and very small dot-like ones, suggestive of chondriosomes (400 ×). 10. Germinating giant cocci from an egg of *Schizoneura* in a hanging drop. Different media, *in vivo* (1000 ×).

water. There again appeared cocci the relation of which to the egg (Plate I, 1 and 2) or mycetome (Plate II, 4) inhabitants was proved especially by their sometimes larger size and by their schizosaccharomyces-like fission. Apart from this, and still more convincing, are the cycles consisting of all three forms in one and the same strain: cocci (originally small), Plate III, 6; cocci + rods, Plate III, 7; sarcinae, Plate IV, 8. Finally, very large, truly giant

cocci are formed, e.g., on the ends of agar slopes, and in no way different from the big inclusions in the eggs. Plate IV, 10 demonstrates a hanging drop with giant cocci prepared from a single egg, sprouting into bacterial rods. By means of phloridzin, a bark glycoside of apple trees, a rod bacterium was isolated which in bouillon produced a red color very similar to that synthesized in the body of the woolly louse. Probably, it did not belong to the chief flora of the mycetomes or eggs. From these surprising similarities in form of the *Azotobacter chroococcum*, I do not doubt that the bacterial symbiotes of *Schizoneura lanigera* as well as those of other aphids belong to this genus. Of course, they must not be mistaken for *Sulcia* when it appears in aphids. There were isolated more than 10 strains of *Azotobacter* symbiotes from *Schizoneura*. The pure cultures of the aphid symbiotes grew adequately on media poor in nitrogen. Mixed cultures consisting of the cocci secured from *Phylloxera* or *Schizoneura* grew still better, even quite well; the same slimy bacterium alone did not grow prolifically, but in the mixed cultures with the symbiotes there appeared characteristic, even vigorous, membranes resembling mixed cultures of *Radiobacter-Azotobacter autorum*. A bacterium reminding one of *Radiobacter* and already described by Krassiltchick was isolated from the chylus-stomach of an aphid.

I was at that time unable to kjeldahlize my cultures, having no H_2SO_4 at my disposal, for it was requisitioned for war purposes. Moreover, the cultures were lost in those unsettled times. As is known (*16*), the numerous analyses with the cultures of aphid symbiotes executed by Tóth showed that they are really able to fix nitrogen. And I proved the same with the larvae of numerous other insects containing *Sulcia* and *Azotobacter* (*9, 10*).

The question of "mitochondria as organisms" is now more than ever in the air. With regard to the latest literature referring to some "isolates" from the mouse-ascites tumors supposed to be mitochondria, I can quote *Naturwissenschaften* (*17*): Seyfarth *et al.*, 192; but, on the contrary, see Lettré, *ibid.*, 267. The large sarcosomes figured by Watanabe and Williams (*18*) and considered by these authors, as well as by Lanham, to be mitochondria, may, in my opinion, rather be *Sulcia*, owing, especially, to the fact that they propagate by budding. Also, their forms and size correspond to my cultures of those organisms from the above-mentioned insects. For a long time I have suspected that the symbiotic fungus *Sulcia* studied by me and isolated from the caterpillars of *Liparis monacha* L. (unpublished) can produce, in addition to the great hypertrophy changing it into very complicated propagation structures, granules—particles—so very minute that they closely resemble chondriosomes. With the aid of streptomycin one also can evoke them in great numbers in cultures. I have published, in 1950 (*10*) and in 1951 (*11*), a picture of *Sulcia* growing in the fat body of *Drosophila*. A photograph of the mycetome (Plate IV, 9) from a very young caterpillar of *Lymantria monocha* shows many micro-sulciae, some of which are of such extremely fine size that they might be taken for mitochondria. Should this be proven—which so far is only the music of the future—then it would represent the first instance of a definite microorganism producing mitochondria. In this respect one should also consult Tóth (*19*) regarding the main cells (Hauptzellen) of the salivary gland of *Stomaphis graffii-platanus* that very likely contain numerous micro-sulciae. The inclusions of rat liver cells described by Lagersted (*20*, Fig. 13) and others possibly also belong here.

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News and Notes

Fifteenth Physics Colloquium

More than 100 college physicists from many parts of the nation gathered at the State University of Iowa June 17–20 for the 15th annual Colloquium of College Physicists and the Associated June Lectures, delivered this year by President E. U. Condon of the American Association for the Advancement of Science.

While Condon's talks on "Physics of the Glassy State" highlighted the colloquium activities, several other addresses were given by representatives of industrial and educational physics. The four-day meeting also featured an exhibit of teaching devices and publications prepared by the members.

Condon gave four lectures, on "Constitution and Structure," "The Transformation Range," "Strength of Glass," and "Radiation-Sensitive Glass." During the highly technical lectures, he urged the physicists to delve "more deeply and be richly awarded by learning for yourselves about the many fascinating and still unsolved problems of the 'Physics of the Glassy State'."

Dean Wooldridge, vice-president for research and development at Hughes Aircraft Company, urged the college physicists to try to channel some of their students into military work as they exercise the important function of helping the students to choose a career. "Whether we like it or not, many physicists are going to be involved in military work for a long time to come. . . . Nothing short of the attainment of real world harmony and the complete elimination of our military establishments can prevent this," he reminded.

He cited some of the disadvantages of military work, as well as the advantages, but pointed out that the military has long since "discovered science," and that the same economic considerations of modern warfare which make it easy for the physicist to develop useful ideas will make it correspondingly difficult to disentangle himself from military work.

"Inventive practical ideas worth following up are much easier to come by in the military than in commercial fields, because of the very direct manner in which modern scientific techniques may be brought to bear upon the most vital military operation," he concluded.

After hearing from President Austin N. Stanton of the Varo Manufacturing Company "that all students are creative," the teachers were presented with two relatively new theories for aiding this creativity among their students.

Stanton said most students have the five requisites for creativeness—inspiration, faith in themselves, tools, successful completion of projects, and the dignity and respect arising from recognition.

"Many tests have been devised to predict the potentials of young people, but I sincerely hope that none ever prove successful. . . . No one uses more than a small fraction of his mental capacity. Why should it be assumed that this fraction should be the same for any two individuals? . . . The one whose total mental capacity is smaller than his neighbor's might easily use a slightly larger fraction and surpass him in creative thinking and work."

S. W. Cram of Kansas State College introduced the theory that each student should be required to bring to his final physics examination a half-sheet of paper containing any information he wishes. "The use of the sheet helps to eliminate some of the strain on the student's nervous system, and it encourages the student to make a thorough review of the subject."

The "Cram Sheet's" greatest aid seems to go to the average student, particularly one who lacks confidence, poise and organizational ability, and formulating and using the sheet helps him to develop these very faculties, according to the professor.

Next, Ralph O. Kerman of Kalamazoo College, Kalamazoo, Mich., suggested that "It is desirable to have a physics experiment in which originality in the research spirit is stressed. . . . The student is presented with a problem and he is given no pointers on procedure. Such a method offers stronger student motivation and it makes the experiment a challenge, not a chore."

"Transistor Physics" were discussed by John R. Haynes of the Bell Telephone Company's laboratories, and "Crystals" by F. Hubbard Horn of General Electric Company. Samuel K. Allison of the University of Chicago lectured on "Atomic Physics."

Alexander Stern of Flushing, N. Y., discussed "Some Concepts of Modern Physics," and Dean Thomas H. Osgood of Michigan State College outlined the "Physics of Golf."

"Techniques and Applications of Neutron Diffraction" were described by M. K. Wilkinson, Oak Ridge National Laboratory.

The four-day meeting was sponsored by the National Science Foundation, the Research Corporation and the State University of Iowa. G. W. Stewart, professor-emeritus of physics at Iowa, was in charge of the colloquium.

Scientists in the News

Benjamin Alexander, an authority on blood-clotting and hemorrhage, has been appointed Associate Professor of Medicine on the Harvard University medical faculty. He will continue in his post of Associate Director of Medical Service at the Beth Israel Hospital, which is one of seven major teaching institutions affiliated with the Harvard Medical School.

John A. Behnke, Associate Administrative Secretary of the AAAS, has been appointed the Association's

representative on the Advisory Committee of the National Citizens' Committee for Educational Television. The appointment was made in response to an invitation from the Committee for active participation of the Association in its work.

Wallace R. Brode, Associate Director of the National Bureau of Standards and a member of the Board of Directors of the AAAS, has been appointed an Association representative to the Scientific Manpower Commission. He joins Detlev W. Bronk, retiring President of the AAAS, who is already serving.

At a ceremony held in Unesco House in Paris, **Julian Sorell Huxley** was awarded the Kalinga Prize in science writing. Dr. Huxley was nominated by both the Royal Society of Great Britain and the Institut de France. The jury was composed of Dr. M. N. Saha, Professor of Physics at the University of Calcutta, Professor A. J. Kluyver of the Technische Hogeschool of Delft, and Mr. Paul Gaultier, Member of the Institut de France and a well-known editor and publisher.

George C. Kennedy has left the Department of Geology, Harvard University, to accept an appointment as Professor of Geochemistry on the staff of the Institute of Geophysics, University of California at Los Angeles.

The Smithsonian Institution's oldest employee, **Andrew Kramer,** retired recently after nearly 61 years of service. Mr. Kramer is an instrument maker who has produced some of the most precise instruments known to science. He joined the Institution in 1892, and so was one of the small group who worked with Samuel P. Langley on his famous airplane and the models that preceded it. Ever since, Mr. Kramer has been associated with the Institution's Astrophysical Observatory, started by Secretary Langley. Much of the work has required the greater and greater refinement of such equipment as pyrheliometers and pyranometers, which measure extremely fine differences in solar heat radiation. Some of these instruments are sensitive enough to measure accurately the heat of a candle 20 miles away.

Mr. Kramer was concerned with the construction of instruments rather than with their design. Yet he thoroughly understood their theory and purpose and often devised methods to increase the precision of their measurements. One of his major achievements was the chamber for Abbot's water-flow pyrheliometer, said by the head of the German meteorological service to be the only standard of solar measurements in the world.

Brian H. Mason, formerly Associate Professor of Mineralogy at the University of Indiana, has been named Curator of Physical Geology and Mineralogy at the American Museum of Natural History, New York.

Edgar G. Miller, Jr., Professor of Biochemistry at Columbia University, has been appointed Dean of the graduate faculties.

Education

Columbia University has established a new Institute for the Study of Human Variation. It will seek to learn about man by observing the physical differences between individuals, and it is expected that information concerning the working of the human mind and body, and the mechanisms of evolution will be obtained. The Institute will provide for coordination of several sciences in the study of two basic problems: the nature of the biological factors responsible for variation in human beings, and the nature of the processes by which changes occur in animal populations, human and otherwise. Graduate courses will begin with the 1953 winter session. The staff of the Institute will comprise specialists at Columbia in the fields of genetics, zoology, anthropology, pediatrics, psychology, serology, and mathematical statistics, as well as experts from Great Britain, India, and Australia. Leslie C. Dunn, geneticist and Professor of Zoology at Columbia, will be Director. The Institute will be at the Morningside Heights campus; however, the resources of the Medical Center and several local hospitals will be used. Experimental work on non-human animal populations will take place at the university's Nevis Biological Station at Irvington-on-Hudson, and at the Genetics Laboratory in Schermerhorn Hall.

The **Stanford Laboratory,** Stanford University, has been reorganized as the W. W. Hansen Laboratories of Physics in honor of the late professor of physics. The laboratories will consist of two divisions, a microwave unit and a high-energy physics laboratory. Dr. Hansen, a pioneer in ultra-high frequency communications, died in 1949 at the age of 39.

University of Texas engineers are designing new supersonic wind tunnel equipment to simulate take-off conditions for high-speed aircraft. The equipment will allow scientists to determine in detail just how jet and rocket engines operate as an aircraft makes its take-off climb.

Construction of **Yale University's** new underground atomic laboratory has been completed and a 20,000,000 volt linear accelerator is scheduled to begin operation late this summer. Howard L. Schultz and Walter G. Wadey, Associate and Assistant Professors of Physics, are supervising installation of the new atom-blasting equipment.

Grants and Fellowships

The **Damon Runyon Memorial Fund for Cancer Research** made the following allocations totalling $197,830, for the month of June:

Grants

New York University-Bellevue Medical Center, $81,860 for a study under the direction of Norton Nelson, Associate Professor of Industrial Medicine, entitled "Cancer of the Respiratory System; from Environmental Sources—An Experimental Study of Cancer of the Lung and Other Parts of the Respiratory System Arising from Air Polution." The grant continues the project for a second year.

Polytechnic Institute of Brooklyn, $15,000 for a project under David Harker.

Columbia College of Physicians and Surgeons, $3,200 for a project being conducted by Raffael Lattes entitled "Cytochemical Studies of Nucleic Acid & Protein Synthesis in Cultured Cells During the Mitotic Cycle, with Particular Reference to the Effects of Certain Anti-Metabolites."

Yale University, $10,750 for a study now being carried on by the Chairman of the Department of Pharmacology, Arnold D. Welch.

The Dade County Cancer Institute, Miami, $7,800 for a project directed by C. G. Grand.

University of Minnesota School of Medicine, $15,000 for a re-study of operations on patients suffering with gastric, colic, and rectal cancer. Owen H. Wangensteen is supervisor of the project.

University of Louisville, $6,700 for continuance of a project under the direction of Harold F. Berg.

University of Colorado School of Medicine, $7,800 for a project, "Studies of Some Endocrinological Aspects of Neoplasia," being conducted by Robert Huseby under the supervision of Ward Darley, Dean of the Department of Medicine.

University of Washington School of Medicine, $12,700 for a project under the direction of Evarts A. Graham.

Michael Reese Hospital, Chicago, $13,500 for a project being conducted by Albert Tannenbaum, Director of the Department of Cancer Research.

Fellowships

T. C. Hsu, $5,000 for a project now under way at the University of Texas, Galveston.

Albert Schilling, $4,800 for a project at Harvard University and the Massachusetts General Hospital, Boston.

Jeanette C. Opsahl, $4,200 for a project at the University of Alberta, Edmonton, Canada.

Cyrus E. Rubin, $2,700 for the continuance of a project at the University of Chicago.

The **Mario C. Giannini Memorial Fund** has been established in honor of the late assistant dean of New York University's College of Engineering. Income from the fund will be used to provide an annual award, the form of which will depend on the final total of contributions, to a mechanical engineering graduate of the evening division who has demonstrated outstanding promise. Professor Giannini, a faculty member for 25 years, died in August, 1952.

The **National Foundation for Infantile Paralysis** has announced research and professional education projects amounting to $2,283,384. Of the total authorized, $762,380 was allocated for research seeking means of preventing the disease and for improved methods of treatment, and $1,521,004 for programs in professional education. This action brings to $50,000,000 the amount provided in March of Dimes funds since 1938 for the study of medical care problems, aid to professional education, and the support of polio research. Included in the professional education projects are four pilot studies "to integrate the concept and skills of complete medical rehabilitation" in the curricula of medical schools, to be conducted at The George Washington School of Medicine, University of Pennsylvania School of Medicine, New York University College of Medicine, and Cornell University Medical College.

The **National Fund for Medical Education** has awarded grants totaling $1,944,151 to 79 medical schools. The fund, established in 1949, is financed by gifts from corporations and the medical profession. Although the grants are unrestricted, they are primarily designed to enable schools to retain valuable personnel, fill teaching vacancies, create new faculty posts, and initiate teaching experiments. They will be apportioned at the rate of $20 for each undergraduate medical student, plus a lump sum of $15,000 for each of the 73 four-year schools and of $7500 for each of the six two-year basic medical sciences schools.

The **Procter & Gamble Company** has awarded 29 graduate fellowships at 19 universities, involving an expenditure of approximately $90,000, for studies in the fields of chemistry, chemical engineering, and mechanical engineering for the academic year 1953–54. These grants continue an established program of supporting the development of outstanding research men and further encouraging fundamental scientific investigations. The administration of the fellowships is handled completely by the participating schools as regards selection of students and specific fields of research, with no restrictions on publication or results. Normally, candidates in their final year of doctorate study are preferred, but this is not a necessary requirement. In addition to the fellowships, research grants totaling about $77,000 have been awarded to several universities to support the continuation of fundamental studies in the fields of biochemistry, analytical chemistry, radiochemistry, and medical research during the year 1953.

In the Laboratories

American Cyanamid Company's Calco Chemical Division is planning to build a $14,000,000 titanium dioxide plant on the outskirts of Savannah, Georgia. Construction will begin in the last quarter of this year and is expected to be completed early in 1955. The plant will occupy a 1600-acre tract of land extending along two miles of the south shore of the Savannah River.

Bio-Rad Laboratories, Berkeley, Calif., has established a new service which will provide ultracentrifugal analysis and separation to industrial organizations, research laboratories, and consulting groups. The new service is especially designed to aid petroleum and pharmaceutical research and analytical groups, and educational, government, and high-polymer chemical manufacturing organizations.

Consolidated Vultee Aircraft Corporation has a giant-sized camera that requires film 3½ feet wide and 4 feet high. The camera, which is used to reduce and enlarge wall charts and blueprints, is 29 feet long, 10 feet high, and has a copy board 12 feet wide and 5 feet high.

Du Pont has announced a $2,000,000 expansion program at two of its plants manufacturing "Freon" fluorinated hydrocarbon compounds for the refrigeration and aerosol industries. The major part of the new facilities will be located at the Chambers Works plant of the Organic Chemicals Department at Deepwater point, N. J., and the balance of the program will be carried out at East Chicago, Ind.

Meetings and Elections

The **American Home Economics Association** elected the following officers for 1953–54: president, Elizabeth Sweeney Herbert, *McCall's* magazine, New York, N. Y.; recording secretary, M. Gertrude Holloway, University of Delaware, Newark; treasurer, Evalyn Bergstrand Owens, Dousman, Wis.; executive secretary, Mildred Horton. The vice presidents are Beulah V. Gillaspie, Purdue University, Lafayette, Ind.; Frances Clinton, Oregon State College, Corvallis; and Edna Hill, University of Kansas, Lawrence.

The **American Society for Experimental Pathology** has elected the following officers for 1953–54: president, D. Murray Angevine, University of Wisconsin, Madison; vice president, Russell L. Holman, Louisiana State University, New Orleans; secretary-treasurer, Cyrus C. Erickson, University of Tennessee, Memphis.

The **American Society of Plant Physiologists** has elected the following officers for 1953–54: president, T. C. Broyer, University of California, Berkeley; vice president, A. S. Crafts, University of California, Davis; secretary, Aubrey W. Naylor, Duke University, Durham, N. C.; executive secretary-treasurer, J. Fisher Stanfield, Miami University, Oxford, Ohio.

The **Iowa Academy of Science** has elected the following officers for 1953–54: president, H. Garland Hershey, State Geological Survey, Iowa City; vice president, R. W. Getchell, State Teachers College, Cedar Falls; editor, F. G. Brooks, Cornell College, Mt. Vernon, Iowa; secretary-treasurer, Cornelius Gouwens, Iowa State College, Ames.

The **Nebraska Academy of Sciences** has elected the following officers for 1953–54: president, I. L. Hathaway, University of Nebraska, Lincoln; vice president, Henry M. Cox, University of Nebraska, Lincoln; secretary, C. B. Schultz, University of Nebraska, Lincoln; treasurer, C. E. Rosenquist, University of Nebraska, Lincoln; corresponding secretary, H. L. Weaver, University of Nebraska, Lincoln.

Miscellaneous

The Carnegie Institution of Washington has announced the publication of ***Algal Culture: From Laboratory to Pilot Plant.*** The monograph, to which many distinguished investigators in the field have contributed, summarizes the current work bearing upon the mass culture of algae as a possible means of increasing the world's supply of vegetable protein. Dried algal cells grown under favorable conditions contain over 50 per cent protein, or more than is found in any of the higher plants.

The first of a series of current status reports on Federal support for scientific research and development has been issued by the National Science Foundation. The report, ***Federal Funds for Scientific Research and Development at Nonprofit Institutions, 1950–1951 and 1951–1952,*** provides the most complete and detailed compilation of information that has been made about that part of the Federal research and development budget represented by grants and contracts from Federal agencies to nonprofit institutions.

The report shows that about $338 million out of a total of $2.2 billion of Federal funds expended for research and development during the year ending June 30, 1952, went toward financing research at nonprofit institutions. Seventeen Federal agencies administered these funds, but four agencies—the Department of Defense, the Atomic Energy Commission, the Department of Health, Education, and Welfare, and the Department of Agriculture—accounted for about $330 million (98%) of the funds. These four agencies spent 83% of the research money at only 50 institutions, excluding "research centers." The report points out that less than one-third of the educational institutions with "immediate potential capacity" for carrying out research and development have received government funds.

About one out of every five dollars which went to nonprofit institutions in 1951–1952 was for basic research; the other four went for applied research, development, and large-scale additions to the research and development plants of these institutions.

"The Trapping of Solar Energy: A Symposium," which was presented at the Annual Meeting of the Ohio Academy of Science at Kent State University, Kent, Ohio, on April 18, 1952, will appear in the September, 1953, issue of the *Ohio Journal of Science* (Vol. LIII, No. 5).

Recent **visitors from abroad** at the National Bureau of Standards:

Marcel van Laethem, Consulting Civil Engineer, Louvain, Belgium.

Sister Lignori del Rosario, Dean, College of Liberal Arts, St. Scholastica's College, Manila, Philippines.

Shukichi Nagatomi, Manager, Research Department, Tungaloy Manufacturing Company, Ltd., Kawasaki, Japan.

Jaques Buzon, Research Engineer, French Petroleum Institute, Paris, France.

Wolfhart Weidel, Research worker in biochemistry, Max Plank Institute, Tubingen, Germany.

Sigvard Tamner, in charge of microwave tube development at A.B. Svenska Elektronic, Stockholm, Sweden.

Akihisa Narimatsu, Kowa Optical Works, Nagoya, Japan.

H. J. Fisher, Metallurgist, Department of Mines & Technical Surveys, Ottawa, Ontario, Canada.

M. Sugimoto, Government Technical Officer, Ministry of International Trade and Industry, Tokyo, Japan.

Leo Werner Suffert, Faculdade de Odontologia de Porto Alegre, Porto Aleore, Brazil.

A. F. Chhapgar, Research Officer, National Physical Laboratory of India, New Delhi, India.

Technical Papers

Methionine—Origin of Sunlight Flavor in Milk[1]

Stuart Patton and Donald V. Josephson

The Pennsylvania Agricultural Experiment Station, State College

Exposure of milk to daylight, in conventional glass milk bottles, for periods of about ½ hr or more produces an objectionable flavor commonly known as "sunlight" or "activated" (*1–6*). Wavelengths of light in the visible spectrum are responsible for the flavor. Incident to its production, most of the ascorbic acid and a substantial part of the riboflavin in the milk are destroyed (*3, 4*). Therefore, sunlight flavor in milk has important economic and nutritional implications. Sulfur-containing compounds are associated with the flavor (*2, 5*) and a derived protein from heated whey will produce the flavor on exposure to sunlight (*2, 6*). Experiments at this laboratory have indicated that the flavor substance has its origin in methionine and that flavor production is dependent, in a large measure, on the presence of riboflavin.

In these experiments, all samples were exposed for 1 hr to sunlight of an intensity which varied between 400 and 600 Weston units. During exposure samples were retained in conventional flint glass, quart milk bottles. For each exposed sample an unexposed control was prepared and held in a refrigerator. Flavor was determined by three judges, experienced in the identity and evaluation of sunlight flavor.

The importance of methionine in sunlight flavor production first was suspected when exposure of dilute aqueous solutions of this amino acid was observed to develop a flavor apparently identical with that produced on exposing milk. Further study revealed that the addition of methionine in quantities as little as 4 mg/qt greatly enhanced production of the flavor in skim milk (Table 1). From these data it is evident that the flavor production mechanism can function independently of temperature. The readiness with which the flavor formed in skim milk as compared with pure solutions of methionine suggested that some milk constituent aids in flavor formation. In this regard, riboflavin was considered a logical possibility since it is the only skim milk component showing appreciable light absorption in the visible region. Distilled water solutions of methionine (20 mg/qt) and riboflavin (1.5 mg/qt) were prepared and exposed. The sample containing methionine developed a slight but noticeable degree of typical sunlight flavor, whereas that containing methionine and riboflavin developed the flavor to an extreme degree. The sample containing only riboflavin had no detectable flavor of any kind. It was noted with interest that the unexposed sample containing methionine and riboflavin developed some sunlight flavor during its preparation and storage in the refrigerator, a period of about 1.5 hr. This was the only instance in which any control sample exhibited a flavor remotely resembling that in question.

TABLE 1

EFFECT OF ADDED DL-METHIONINE ON THE DEVELOPMENT OF SUNLIGHT FLAVOR IN SKIM MILK*

Sample No.	Methionine added (mg/qt)	Exposure time (min)	Temperature after exposure of storage† (°C)	Flavor intensity‡
1	None	0	5°	0
2	None	60	8°	1
3	50	0	5°	0
4	4	60	8°	3
5	20	60	8°	4
6	50	60	8°	4+

* Exposed in conventional quart bottles to direct sunlight of 400 Weston units intensity.

† Outdoor temperature, 2° C, initial temperature of the milk 5° C.

‡ 0, no sunlight flavor; 1, slight; 2, medium; 3, strong; 4, very strong sunlight flavor.

It seemed of interest to determine whether other sulfur-containing amino acids, such as cysteine or cystine, would augment sunlight flavor in skim milk in the manner shown by methionine. These two amino acids and methionine were added separately to quart samples of skim milk at a rate of 20 mg/qt. The samples together with a control, containing no added amino acid, were exposed and then examined for flavor. The samples containing cysteine and cystine exhibited about the same degree of sunlight flavor as the control. The flavor was greatly intensified in the sample containing methionine. Thus the flavor appears to result rather specifically from photolysis of methionine. The specific nature of this interesting chemical change in an essential amino acid, which is activated by solar energy and intensified by the presence of a naturally occurring pigment, will be the subject of further investigation.

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Manuscript received March 23, 1953.

[1] Authorized for publication on March 17, 1953, as paper No. 1793 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

Failure of Phosphorylated Hesperidin to Influence Fertility in Rodents

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Phosphorylated hesperidin has been reported to have a powerful inhibitory effect upon fertility when administered orally in man (*1*) and orally or intraperitoneally in rats (*2*). In contrast to these findings, we have observed no antifertility action in rats or mice by either route in several series of tests.[1]

The phosphorylation of hesperidin may lead to a great variety of products, depending upon the method and conditions employed. In the above reports no definitive or analytical data were given for the material used in the tests. In June 1952 we prepared several samples of phosphorylated hesperidin using the technique of Beiler and Martin (*3*). One of these products (designated Ortho) was administered to rats in the well-controlled experiment described below to determine whether it had any effect upon the pregnancy rate. Later in the year, through the kindness of B. F. Sieve, we received samples of the material used by him in his extensive tests in the human being (*1*). This compound also was subjected to the same tests.

The test for interference with the pregnancy rate was conducted as follows. Mice or rats were pretreated with the experimental compound for 5–7 days before the mating period began. Females and males were grouped in a ratio of at least 3:1. A mating period of 15–28 days followed, during which time accurate records were kept of the weight, food consumption, and condition of the animals. This period was followed by a postmating period of 20–25 days. Records were kept of the number and size of litters and of the date of parturition. In our colony over a period of years the fertility rate for our strains of animals under no treatment has been 85–90% for rats and 70% for mice; rats and mice fed by stomach tube, about 50–60%, and for mice receiving intraperitoneal injections, about 40–50%. Nevertheless, complete controls were used, in which the control group was given water or saline by stomach tube or injection to parallel those experimental groups undergoing such treatment.

TABLE 1

FERTILITY RATES IN RODENTS

Material	Species	Route	Sex treated	Level mg/kg/day	Nos. of ♀'s littering		% ♀'s littering	
					Control	Exptl	Control	Exptl
Phosphorylated Hesperidin (Ortho)	Mouse	Oral (stomach tube)	Both	100–125	4/7	12/16	57.0	75.0
	Rat	Oral (diet)	Both	100–125	7/8	14/16	87.5	87.5
Phosphorylated Hesperidin (Sieve)	Mouse	Oral (diet)	Both	50–70	10/15	11/15	67.5	73.3
			♀	50–70	10/15	12/15	67.5	80.0
			♂	50–70	10/15	13/15	67.5	86.7
		I.P. injection	Both	40–50	6/15	7/14	40.0	50.0
			♀	40–50	6/15	9/15	40.0	60.0
			♂	40–50	6/15	6/15	40.0	40.0
	Rat	Oral (stomach tube)	Both	100–125	4/8	8/15	50.0	53.3

Table 1 summarizes the nature and results of the trials. The levels of compound fed were considerably higher than those given by other investigators. Even the lowest oral feeding level in mice exceeded by a factor of some 5 the daily mg/kg level given in the human trials. Examination of the results indicates beyond question that there has been no interference with pregnancy through the oral or intraperitoneal administration of these compounds. Indeed, there appears to be a slight increase in fertility of the treated animals, but the χ^2 values show that the difference between experimental and control groups lacks statistical validity. These results are obviously at variance with those reported for the human being. The reasons for this are not immediately evident, although the possibility may be considered that there exists a wide species difference between rodent and man in the antifertility effects of phosphorylated hesperidin.

Sieve (*1*), commenting on the antifertility effects of phosphorylated hesperidin in the mouse, stated that "it can be concluded from actual experiments that there is definite impairment of fertility of the mice under treatment of phosphorylated hesperidin." However, analysis of the data presented in his article reveals that the P value calculated according to Mainland (*4*) is so large as to make this conclusion dubious

[1] Just after this paper was prepared for publication, Chang and Pincus (SCIENCE, 117, 274, 1953) reported similar failure to achieve an antifertility effect in rats with a commercially prepared sample of the compound.

on the basis of the small number of animals used. The data of Martin and Beiler (*2*) cannot be subjected to analysis as they appear in their report.

The relationship of the phosphorylated hesperidins used in fertility trials to structure, antihyaluronidase potency, capillary permeability, phosphorus content, species, and mode of administration remains obscure, since significant correlations between these factors and fertility inhibition have yet to be reported.

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The Toxicity of Chlordane Vapors

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The vapor toxicity to warm-blooded animals of the insecticide chlordane (1,2,4,5,6,7,8,8-octachloro-4,7-methano-3a,4,7,7a-tetrahydroindane) has been a subject of controversy for the past several years.

Experimental evidence presented in this paper offers an explanation for the variable results shown by previous authors and shows a significant lack of toxicity to mice resulting from chlordane vapors.

Lehman (*1*) was unable to maintain pigeons placed in a room which had been treated with chlordane, although it was first thoroughly scrubbed and aired. Frings and O'Tousa (*2*) reported that mice could not survive in air which had first passed through chlordane. Injury was also noted in mice that had been confined to a chamber whose sides had been treated with chlordane. On the other hand, Nickerson and Radeleff detected no injury to pigeons (*3*) or leghorn cockerels and pullets (*4*) that had been confined 30–60 days in a box whose inner surfaces had been treated with chlordane. Since the only controlled investigation indicating significant toxicity of chlordane vapors to warm-blooded animals is that of Frings and O'Tousa, the author undertook, with their cooperation, an investigation patterned exactly after theirs. The only uncontrollable variable was the source and time of manufacture of the chlordane.[1] Twenty female Swiss albino mice in a wire mesh cage were placed in a treatment chamber 12 × 20 × 36 in. and subjected to 14 days of continuous exposure to a current of air (18 ml/sec) which had first passed through 105 ml of chlordane in a saturation train. No deaths occurred nor did any mice show signs of anorexia, blindness, or loss of coordination. At autopsy, organs and tissues were normal.

[1] All chlordane used in the present investigation was supplied as technical chlordane (1068 chlordane) by the Velsicol Corporation, Chicago, Illinois, and as AAEE Reference Standard chlordane by the Wisconsin Research Foundation, Madison, Wis.

The experiment was repeated 4 times, once using AAEE Reference Standard chlordane for 14 days and 3 times using three different current production batches of chlordane for 25 days each. No symptoms of toxicity were noted, and no deaths occurred. No gross pathological changes were observed, but microscopically the liver showed minimal changes such a some reticulation and oxyphilia of the cytoplasm, and the lungs showed slight congestion with some proliferation of bronchiole lining cells. Kidneys were normal. These results were at such variance with those reported by Frings and O'Tousa that further investigation was certainly indicated.

Early samples of chlordane frequently gave off irritating volatile materials but in production, this characteristic has long since been eliminated by the more complete removal of unreacted ingredients, chief among which was hexachlorocyclopentadiene. Possibly the chlordane (Octaklor, 1947 production) used by Frings and O'Tousa contained a considerable quantity of unreacted volatile material which may have been primarily responsible for the reported symptoms and high rate of mortality among the mice. In order to test this hypothesis, hexachlorocyclopentadiene[2] as utilized in chlordane production was added in varying quantities to 1068 chlordane being sold commercially. Experiments were then conducted in which female mice were subjected to air passing through these mixtures (Table 1).

TABLE 1

Mortality among Mice Subjected to Vapors of Chlordane (Ch) plus Added Hexachlorocyclopentadiene (Hx)

		No. Mice	Mortality ratio	Comments
I	Ch, 90% Hx, 10%	20	20/20	All dead within 24 hr
II	Ch, 92.5% Hx, 7.5%	20	20/20	All dead within 48 hr
III	Ch, 95% Hx, 5%	20	20/20	Symptoms present at 4 days Deaths between 10th and 25th days
IV	Ch, 97.5% Hx, 2.5%	20	6/20	Symptoms present at 4 days Deaths between 20th and 25th days
V	Ch, 100% Control	20	0/20	No symptoms of toxicity.

In every case except that of the chlordane control, external symptoms followed the same pattern described by Frings and O'Tousa, namely, cessation of feeding and drinking, huddling together, lethargy, apparent blindness, and loss of coordination. The mixtures were also irritating to the eyes of workers in the laboratory. Onset and severity of symptoms were directly proportional to the volume of added hexachlorocyclopentadiene.

[2] Supplied by the Velsicol Corporation.

Gross examination of the organs of mice in Expts. I–IV revealed extensive hemorrhagic areas in the lungs and lesions in the livers. Microscopically, the lungs showed in addition to hemorrhagic areas, congestion of capillaries, edema, and some consolidation. The liver showed extensive areas of coagulative necrosis, hyalinization, bile duct proliferation, congestion, cytoplasmic oxyphilia, and disruption of the normal architecture. Kidney damage included evidence of protein leakage, degeneration of tubular epithelium, and capillary engorgement in glomerular tufts. The extent of injury was proportional to the volume of added hexachlorocyclopentadiene.

The results of the above experiments point clearly to the explanation for variance in results between currently produced chlordane and that used by Frings and O'Tousa. When, and only when, hexachlorocyclopentadiene is added to chlordane, the results are in entire agreement with those obtained by Frings and O'Tousa.

Another type of experiment similar to that performed by Frings and O'Tousa, wherein mice were confined to a poorly ventilated box, the inner surface of which had been treated with 5 g of chlordane and renewed every 3 weeks failed to produce any signs of intoxication during a 4-month test. Gross findings at autopsy were negative and histological changes, confined to the liver, were minimal.

It can be concluded from the above investigation that the reported vapor toxicity to mice should not have been attributed to chlordane, but rather to an unreacted intermediate. The intermediate was undoubtedly present in chlordane as manufactured at one time, but has since been reduced to a point where it is no longer present in quantity sufficient to produce significant vapor toxicity to mice.

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Manuscript received March 16, 1953.

An Improved Holder for Seedlings in the Avena Test[1]

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The glass holders and wooden racks used in the standard Avena test method for plant growth regulators (*1*) can be replaced by convenient and easily constructed Lucite racks (Fig. 1). These racks hold the seedlings more firmly, allow straighter growth, hold twice the number of plants in the same space, save considerable time in the selection of uniform rows for testing, and are easily cleaned.

One-quarter inch Lucite is cut into $2 \times 7\frac{3}{8}$-in. strips, for use in standard $10 \times 16\frac{1}{2} \times 2\frac{1}{2}$-in. enamelware pans. Five or six racks will fit in a pan this size. Twenty-four holes are drilled through each strip,

[1] Published with the approval of the Director as Technical Paper No. 212 of the Pineapple Research Institute of Hawaii.

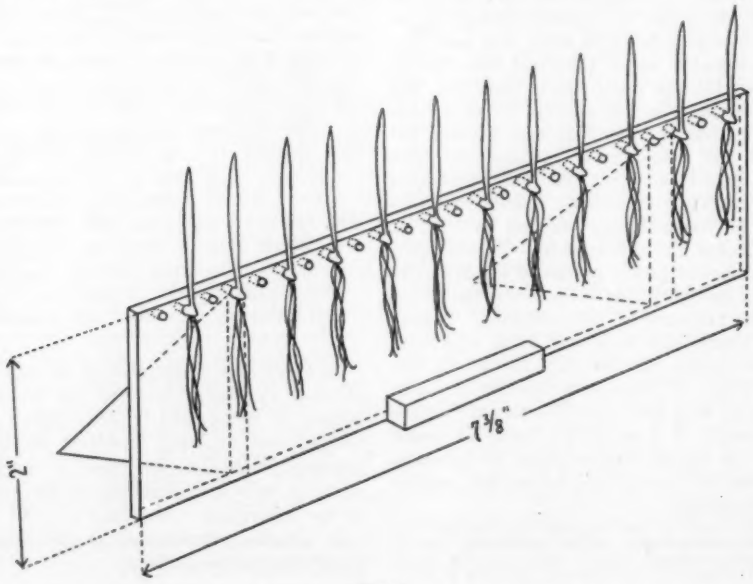

FIG. 1.

⅛-in. from the top and ¼-in. apart, using a ⅛-in. and 7/64-in. drill on alternate holes. Triangular supports are glued to the back and a ¼-in. strip to the front, with Duco cement.

Avena seeds, germinated for 52 hr on filter paper, are placed in 18 or more of the holes in each rack. The racks are then placed in enamelware pans filled to an adequate level with tap water. The following day, obvious discards are made at the first decapitation; rigid selection within each rack may be made at the second decapitation. The seeds are somewhat smaller by this time and the 12 plants used in actual testing usually fit in the evenly spaced holes of smaller size.

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Interaction of Auxin and Temperatures in Floral Initiation[1]

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That auxins can inhibit floral initiation has been known since the early work of Dostal and Hosek (*1*); conversely that auxins can sometimes induce flowering (*2*) or promote flowering (*3*) has likewise been clarified. Subsequent reports have greatly enlarged the reported instances in which auxin can inhibit or promote flowering, but in no other case than the pineapple has auxin been found actually to induce flowering. These facts suggest that plants in general may have various auxin requirements for floral initiation, and in some cases the indigenous auxin level may be supraoptimal (*4*) or in other cases suboptimal for flowering (*3*).

More recently it has been found that the effects on flowering of a given auxin treatment of pea depend to a large extent upon the subsequent temperature experience (*5*). The present study demonstrates that an interaction between auxin (naphthaleneacetic acid) and temperatures in floral initiation exists in all of the types of floral initiation known: that is, in photoperiodic initiation, vernalization, and indeterminate initiation of flowers. In each instance auxins can either promote or inhibit flowering, depending upon the temperature experience following the auxin treatment.

Tests with photoperiod sensitive plants included the long-day species Wintex barley, and the short-day species Biloxi soybean. Seeds were soaked in auxin solutions for 24 hr, after which they were given 18° or 3° C exposures for 2 weeks. They were then planted into the greenhouse under inductive day lengths (18 and 9 hr respectively). The results with the long-day barley are shown in Fig. 1, from which it can be seen that the number of flower primordia was increased over 50% by 0.1 ppm of auxin followed by the 3° C treatment; whereas, the same auxin treatment followed by 18° C treatment did not increase and may have inhibited flower initiation. The results with short-day soybean are shown in Fig. 2. It can be seen that a parallel situation holds here, in that 1 ppm auxin

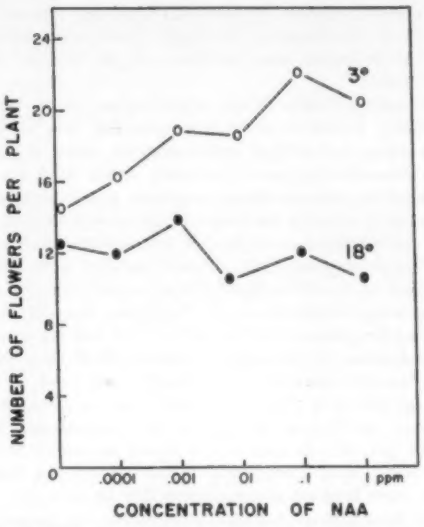

FIG. 1. Effects of treatment of seed of Wintex barley with naphthaleneacetic acid and followed by brief controlled-temperature storage (10 plants/treatment).

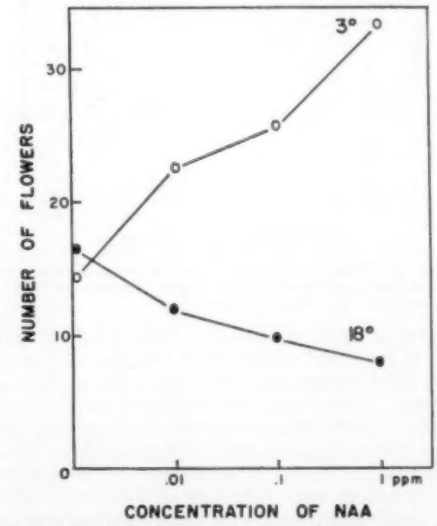

FIG. 2. Effects of treatment of seed of Biloxi soybean with naphthaleneacetic acid followed by brief controlled-temperature storage (10 plants/treatment).

[1] Journal paper No. 716. Agricultural Experiment Station, Lafayette, Indiana.

treatment followed by the cool temperature more than doubled the number of flower primordia, whereas flower initiation was inhibited at the warmer temperature.

Previous studies of the effects of auxin on photoperiodic induction have been applied, not as seed treatments but as leaf treatments. In order to establish whether the same responses might hold in this other type of experience, soybean plants grown to the age of 2 weeks under noninducing day lengths (18 hr) were placed in controlled temperature rooms receiving fluorescent light of 800 ft-c. They were photoinduced by five 9-hr days, one set experiencing a constant temperature of 25 ± 2° C and the other 10 ± 1° C during the photoinduction period. The leaf tip was removed from the youngest mature leaf of each plant and the cut surface was constantly immersed during this period in a vial containing water or auxin solutions, according to the method of Leopold and Thimann (*3*). At the end of the 5-day induction period the plants were transferred to the greenhouse, where they were kept on non-inducing day lengths (18 hr) until dissection at 7 weeks. The results are presented in Fig. 3, from which it can be seen that low concen-

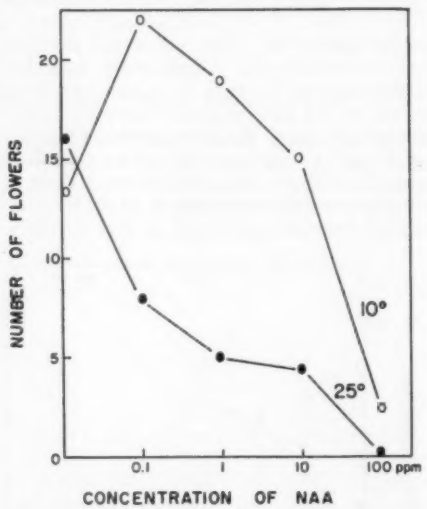

FIG. 3. Effects of treatment of leaves of soybean with naphthaleneacetic acid during photoinduction at different temperatures (10 plants/treatment).

trations of auxin (0.1–1 mg/l) promoted floral initiation at the lower temperature, whereas only inhibitions of flowering were obtained at the higher temperature. These results are strikingly parallel to the results obtained when seed-soak treatment was used.

An interaction of auxins and temperatures in vernalization has already been reported (*6*) with barley. Similar results have now been obtained with winter rye. Seeds were treated with auxin solutions and temperatures in the same manner as above. Simultaneous experiments were carried out with embryos excised after the auxin treatment and subsequently grown on sugar and agar medium. The results of the experiment are shown in Table 1, from which it can be seen

TABLE 1

FLOWERING OF WINTER RYE AS AFFECTED BY TREATMENT WITH AUXIN (0.1 PPM NAPHTHALENEACETIC ACID) FOLLOWED BY BRIEF CONTROLLED-TEMPERATURE STORAGE

		No. flowers (spikelets) per plant	
		Water controls	Auxin treated
Intact seeds,	18°	8.2	1.5
	3°	5.1	14.3
Excised embryos,	18°	6.3	5.0
	3°	4.0	12.4

that the auxin treatment followed by brief vernalization at low temperature nearly doubled the number of flowers, whereas the same auxin treatment at the higher temperature in the intact seeds inhibited and in the excised embryos had no effect on floral initiation. The similar responses of intact seeds and excised embryos indicates that the endosperm is not essential for the response.

The same interaction of auxins and temperatures in floral initiation of the indeterminate plant Alaska pea has already been reported (*5*). It was shown that auxin seed treatment followed by 10° C resulted in quantitative promotions of flowering (expressed as earliness), whereas the same auxin treatments followed by 20° C produced quantitative inhibitions of earliness.

These experiments indicate that auxins can modify floral initiation as a function of photoperiodism, vernalization, or indeterminate behavior, and that the manner of response is strikingly parallel in each case. Promotive responses to auxins were obtained in every case where short low-temperature treatments were employed, and conversely either no effect or inhibitory effects were obtained when higher temperatures were experienced. These observations are highly suggestive that the physiological mechanisms which control flower initiation by photoperiod, by vernalization, or by indeterminate means have close biochemical similarities.

Earlier workers have reported that the treatment of seeds with auxins could increase growth and flowering performance (*7–9*) but subsequent attempts to utilize this seed treatment as an agricultural practice failed (*10*). It is suggested that appropriate control of temperatures experienced by the seeds after auxin treatment may bring more consistent beneficial effects in the promotion of flowering.

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Zinc Phosphate Identified as a Constituent of Urinary Calculi

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For several years x-ray diffraction has been in use in the physics department of this institute for the analysis of urinary calculi. During this time approximately 192 stones have been studied. The method used has been described in a comprehensive paper by Prien and Frondel (*1*) and also in a subsequent paper by Prien (*2*). In general the study of calculi which has been made here agrees well with the findings of the above workers. Several different rare patterns have been obtained, however, that have not previously been recognized as possibilities. It is the purpose of this paper to report one of these findings.

In March 1951 a calculus was received measuring 39 mm along its largest axis. The stone was analyzed as principally a mixture of carbonate-apatite and magnesium ammonium phosphate hexahydrate. A totally different pattern was obtained from several yellowish-white concentric layers and from the thin outer crust (Fig. 1). This pattern was not at the time identified.

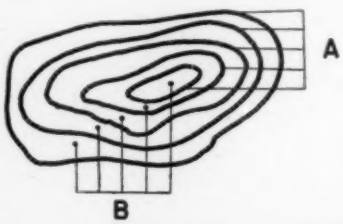

FIG. 1. Zinc phosphate in large calculus. A, zinc phosphate: B, carbonate-apatite and magnesium ammonium phosphate.

In December 1952 a 20-mm calculus was received from a different patient. The large central portion of this stone (about 80%) was yellowish white and gave a diffraction pattern identical with that of the unknown calculus pattern noted above. Surrounding the central portion was a layer of dark calcium oxalate monohydrate (Fig. 2). This dark layer was covered with a thin crust of the central material.

The fact that the relative intensities and the

FIG. 2. Zinc phosphate in small calculus. A, zinc phosphate: C, calcium oxalate.

d-values of the diffraction lines produced by the unknowns were the same led to the belief that they were most likely produced by a single constituent. It was recognized that different states of hydration of commonly occurring compounds might account for the appearance of this unfamiliar pattern. Spectrographic analysis[1] indicated zinc and phosphorus as the elements present in major proportions. X-ray diffraction interplanar spacing data[2] for zinc phosphate were consulted. Although the available diffraction spacings for $Zn_3(PO_4)_2 \cdot 4H_2O$ contained fewer *d*-values than the calculus pattern, the given spacings agreed closely in *d*-values and relative intensities with the pattern lines.

For more complete verification the compound was prepared in the chemical laboratory by combining solutions of the soluble salts—zinc chloride and sodium orthophosphate. After the precipitate was washed well and recrystallized from orthophosphoric acid, it gave a diffraction pattern which was identical with that of the unknown calculus powder. Table 1 shows clearly the close agreement of the calculus pattern and that of the prepared $Zn_3(PO_4)_2 \cdot 4H_2O$.

No explanation for the urolithiases of the zinc phosphate calculi described in this paper has been offered.

TABLE 1

COMPARISON OF X-RAY DIFFRACTION POWDER PATTERN INTERPLANAR SPACINGS*

Only lines with relative intensities of 4 and above have been included in this table. In all, 63 lines with *d* values down to 0.905 have been checked and confirm the identification of the pattern.

Calculus*		Prepared powder†		Calculus		Prepared powder	
d‡	I/I_1§	*d*	I/I_1	*d*	I/I_1	*d*	I/I_1
9.21	9	9.17	9	2.61	4	2.61	6
5.32	4	5.32	5			2.54	5
5.08	5	5.11	5	2.53	4	2.51	5
4.86	6	4.86	6	2.27	5	2.27	6
4.59	7	4.58	8	2.10	4	2.10	5
4.42	6	4.42	7	2.01	4	2.01	6
3.99	5	3.99	6	1.94	6	1.96	7
3.88	4	3.88	4	1.83	5	1.83	6
3.47	5	3.47	6	1.57	5	1.57	6
3.39	8	3.39	8	1.53	4	1.53	5
2.86	10	2.86	10	1.51	4	1.51	5
2.65	4	2.65	5				

* Unknown calculus pattern.
† Chemically prepared $Zn_3(PO_4)_2 \cdot 4H_2O$.
‡ Values in angstrom units.
§ Relative intensity (visual estimation).

[1] This analysis was made through the courtesy of the Research Laboratories Division, General Motors Corporation.
[2] Interplanar spacing cards prepared by American Society for Testing Materials, 1950 edition.

Zinc is known to be a constituent of most foods and in small quantities is necessary for body nutrition (*3, 4*). Although small traces of zinc can occur in urine, the major portion of this element entering the body is excreted by way of the intestinal tract.

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Effect of Ethylenediamine Tetraacetic Acid on Adenosinetriphosphatase Activity

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Calcium ion is considered indispensable for the enzymic function of myosin-adenosinetriphosphatase, the degree of activation depending on the concentration of adenosinetriphosphate (*1*). Reduction in the availability of calcium ion by citrate (*2*) or oxalate (*3*) results in decrease or complete inhibition of enzyme activity. Ethylenediamine tetraacetic acid (EDTA) is a noncolloidal, organic chelating agent that can deionize a system of its heavy metal and alkaline-earth ions through formation of stable unhydrolyzed complexes. Since EDTA has a strong affinity for calcium ions, the effect of this compound on calcium activated myosin-adenosinetriphosphatase of mouse heart homogenates was studied.

Adenosinetriphosphatase activity was estimated with the procedure of DuBois and Potter (*4*). The buffered substrate was prepared as follows: 305 mg adenosinetriphosphoric acid[1] was dissolved in 10 ml water; 50 ml 0.06 *M* Veronal buffer (pH 7.4) and 10 ml 0.06 *M* calcium chloride were added and the pH readjusted to 7.4 with *N* sodium hydroxide. The volume was made to 100 ml with distilled water and filtered. In the test, 1 ml buffered substrate was added to a 5-ml test tube containing 0.5 ml water or test solution. Five-tenths milliliter C-57 mouse heart homogenate was added and the tubes incubated for 15 min at 37.5°. The quantity of adenosinetriphosphatase that liberates 1 μg of phosphate from adenosinetriphosphoric acid in 15 min is taken as one D-P unit. In the table the activity is expressed as D-P units/milligram of fresh tissue.

A 0.04 *M* buffered stock solution of the disodium salt of ethylenediamine tetraacetic acid[2] was prepared in 0.03 *M* Veronal buffer (pH 7.4) and the pH readjusted with *N* sodium hydroxide. Lower concentrations of EDTA were obtained by diluting the stock solution with the appropriate amount of water and buffer. The solution of EDTA must be buffered to compensate for the hydrogen ions displaced by the combined calcium. In order to exclude pH variation as contributory to the effect on adenosinetriphosphatase, the pH of each complete incubation mixture was determined.

[1] Schwarz Laboratories.

[2] Obtained from Alrose Chemical Co., Providence 1, R. I., through the courtesy of H. M. Zussman.

TABLE 1

EFFECT OF ETHYLENEDIAMINE TETRAACETIC ACID ON ADENOSINETRIPHOSPHATASE ACTIVITY

Molarity EDTA in incubation mixture	Mouse No. 55			Mouse No. 73		
	pH of incubation mixture	Homogenate activity (D-P units)	Per cent original activity	pH of incubation mixture	Homogenate activity (D-P units)	Per cent original activity
0.010	7.1	2.08	8.1	7.2	4.08	13.3
0.008	7.1	4.56	17.1	7.2	5.74	18.5
0.006	7.0	5.68	21.2	7.2	8.14	26.2
0.004	7.2	9.92	37.2	7.2	9.32	30.0
0.002	7.2	41.84	156.0	7.2	50.12	161.2
0.001	7.4	34.96	130.0	7.3	41.12	132.3
0.0001	7.4	29.09	106.0	—	—	—
0.00001	7.4	26.89	100.0	—	—	—
0.0	7.4	26.88	100.0	7.4	31.02	100.0

One mole of EDTA can chelate an equivalent amount of calcium ion. Thus, since the concentration of calcium in the test mixture is 0.003 *M*, this concentration was expected to limit the activation of adenosinetriphosphatase. The results obtained are summarized in Table 1 and Fig. 1. Actually, when the level of EDTA is over 0.003 *M* the enzyme activity is diminished, and above 0.004 *M* this is linear. However, the stimulation observed between 0.001 and 0.003 *M* was not anticipated. With 0.002 *M* EDTA, the adenosinetriphosphatase was over 150% more active than in the original homogenate.

A series of tests was made with various concentrations of EDTA that had been combined with an equimolecular amount of calcium chloride, in Veronal and sufficient *N* sodium hydroxide, so that when added to the incubation mixture, the final pH was 7.3–7.4. The results are represented in Fig. 1, curve C. It is apparent that saturation of the chelation valences of EDTA before addition to the incubation mixture abolishes its effect on adenosinetriphosphatase activity. This indicates that the effects observed are due to the deionization capacity of EDTA and not to a direct toxic action of the compound on the enzyme itself.

The enzyme system utilized may contain toxic ionic species that do not permit maximum activity of adenosinetriphosphatase. EDTA, in concentrations

that are not high enough to limit the calcium activation, can enhance adenosinetriphosphatase activity by combining with these elements. Adenosinetriphosphatase is especially sensitive to minute traces of cupric ion, and it has already been suggested that the favorable effect of cyanide or glycine on the enzyme is due to removal of this ion (*1, 5*). Swanson (*6*) has reported similar experiences with magnesium activated pyrophosphatase and also considers the stimulation by EDTA in noninhibitory concentrations results from the protection of the enzyme from traces of heavy metals. Meyer and Rapport (*7*) found that 0.001 *M* EDTA was partially effective in counteracting the inhibition of hyaluronidase by 5×10^{-5} *M* ferric or cupric ion.

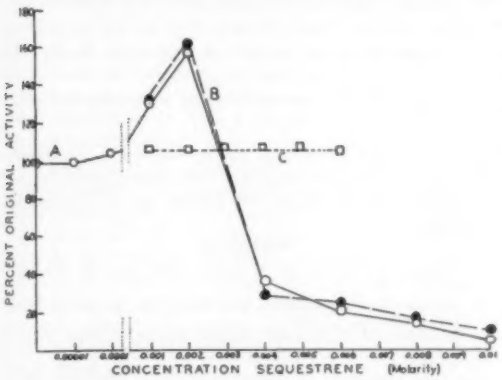

FIG. 1. Effect of ethylenediamine tetraacetic acid on adenosinetriphosphatase of mouse heart homogenate. Curve A, mouse 55; Curve B, mouse 73; Curve C, calcium ethylenediamine tetraacetate.

In any enzyme system affected by inorganic ions, chelation of these factors results in either elevation or diminution of the observed enzymic activity, depending on the relative availability of activating or inhibitory ions. It is conceivable that chelation is an important aspect in both the regulation of enzyme activity *in vivo*, and cellular ionic exchanges generally. Ethylenediamine tetraacetic acid and its effect on adenosinetriphosphatase may be taken as models for this concept. Reversible complex formation by naturally occurring chelating substances, such as keto-, hydroxy-, or amino acids, nucleic acids and proteins, could influence the activity of calcium activated adenosinetriphosphatase by controlling the level of ionic calcium.

Cellular ionic exchanges in general may involve preferential chelation. For example, since the preferential chelation of an ion from a mixture depends on the comparative stability of the ionic complex formed, calcium ion can be expected to displace magnesium from its EDTA complex whereas copper will displace the calcium (*8–10*). The instantaneous intracellular availability of a given free ion may be determined by the resultant equilibrium between competing ions, chelation, and other ion-binding reactions.

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Hydrolytic Enzymes in Hyaluronidase Preparations

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The increasing use of hyaluronidase preparations as adjuvants to local anesthetics, for hyperdermoclysis of medicants, resolution of injection hematomas, and for reduction of lymphedema and traumatic swellings, intensifies the necessity for a complete elaboration of the basic enzymic mechanisms involved. Reported differences in action, specificity, and end products produced by both testicular and bacterial preparations (*1–3*) have led us to suspect that hyaluronidase preparations available for use are actually enzyme mixtures capable of eliciting more physiological effects than the hydrolysis of the as yet incompletely characterized hyaluronic acid. The data enclosed, obtained by surveying commercial preparations for a spectrum of eight hydrolytic enzymes, give validity to this supposition.

Three commercial testicular, one commercial bacterial, and three laboratory streptococcal hyaluronidase preparations were assayed for acid and alkaline phosphatases, total esterases, pseudocholinesterases, lipases, β-D-galactosidases, β-glucuronidases, and sulfatases. The techniques were those of Seligman and co-workers (*4–8*), modified to substitute solutions of the test hyaluronidase preparation for the serum or tissue homogenate ordinarily used. Hyaluronidase assays were done viscosimetrically (*9, 10*). The principle of the method employed is the colorimetric determination of β-naphthol liberated from a variety of naphthyl esters serving as substrates for the enzymes tested, i.e., β-naphthyl acetate for esterases, β-carbonaphthoxycholiniodide for pseudocholinesterases. Table 1, therefore, is expressed as micrograms of β-naphthol liberated per milligram of hyaluronidase test preparation. Average tissue values from

TABLE 1

ENZYME CONTAMINANTS OF HYALURONIDASE PREPARATIONS

μg of β-Naphthol of Preparation/mg of Hyaluronidase Preparation

Enzyme	Incubation time hr	Testicular			Bacterial	Crude bacterial			Av comparative values in tissues*
		A	B	C	D	E	F	G	
Acid phosphatase	2	170	135	92.5	0.25	0.50	0.00	1.25	2.9
Alk. phosphatase	1	7.0	3.5	2.0	0.00	0.00	0.00	0.00	2.6
Total esterases	1	370	465	420	0.80	1.10	0.60	1.10	64
Pseudocholinesterase	1	3.75	5.15	1.90	0.35	0.75	0.75	0.65	41
Lipase	5	1.6	2.2	1.8	23.4	0.00	0.00	0.00	0.0
β-D-Galactosidase	2	12.0	47.0	5.0	0.00	0.00	0.00	0.00	2.7
β-Glucuronidase	4	4.2	0.0	0.4	0.00	0.00	0.00	0.00	—
Sulfatase	24	1.5	0.6	2.5	0.00	0.00	0.00	0.00	4.5/4 hr*
Hyaluronidase		13 V.R.U.	20 V.R.U.	12 V.R.U.	15 V.R.U.	4.8 V.R.U.	3.6 V.R.U.	3.2 V.R.U.	

A, B, C Commercial testicular hyaluronidase preparations.
D Commercial bacterial preparation.
E, F, G Laboratory preparations (streptococcal) beef brain-heart infusion broth (Difco) cultures, Seitz filtered, precipitated with $(NH_4)_2SO_4$, dialyzed, and lyophilized.

* Human serum values for all except β-D-galactosidase (rat liver and sulfatase [rat liver]) as μg β-naphthol liberated/mg of serum protein (based on 7.0 g %).

the literature (*4–8*) are given for the same test conditions.[1]

The data indicate the not surprising observation that testicular enzyme preparations contain appreciably more enzyme contaminants than the bacterial products. The testicular preparations were high in acid phosphatases, total esterases, and β-D-galactosidase, with measurable quantities of the others in most cases. The commercial bacterial hyaluronidase preparation was significantly high only in lipase activity. However, it is somewhat surprising that the relatively crude preparations of laboratory streptococcal material were comparatively free from these accompanying enzymes, whereas the magnitude of the contaminants in the testicular products was far greater than anticipated. For instance, permitting Seligman's assumption that the amounts of β-naphthol liberated are proportional to the times of incubation of reactants, it is seen that 30–50 times the titers of acid phosphatase of serum were found in comparable amounts of testicular enzyme protein tested. In these substances the alkaline phosphatases were of the same order of magnitude as the serum values and total esterases were 6 times as high. For β-D-galactosidase, in the absence of a serum value, an elevation of 2–15 times over that for liver tissue was found. Whereas bacteria are known which produce several of these enzymes, our procedure consisting of filtration, salt precipitation, dialysis, and lyophilization is ample to isolate a product relatively free of the hydrolytic enzymes tested. Accordingly, the variability in substrate specificity of both types of preparation may be attributable to such enzymes with the bacterial varieties being more specific. It is conceivable that the degradation of chondroitin sulfate produced by testicular hyaluronidase and not by bacterial hyaluronidase, as well as certain other differences, may be accountable by regarding the former as an unspecific mixture.

[1] The substrate for β-glucuronidase-8-aminobenzoylnaphthylglucuronide was supplied through the courtesy of Arnold M. Seligman, Beth Israel Hospital Surgical Research Department, Boston, Mass., method unpublished.

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The Influence of epi-F, a Stereoisomer of Compound F, on the Glycogenic Property of Compound F (17-Hydroxycorticosterone)

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All the known naturally occurring adrenal cortical steroids having a hydroxyl group on the eleven carbon are of the beta configuration. Two of these are corticosterone (Kendall's compound B) and 17-hydroxy-

[1] This investigation was supported by an institutional research grant from the American Cancer Society. We also wish to thank Dr. Elmer Alpert of Merck and Company, Rahway, N. J., for generously supplying the epi-F used in this study.

corticosterone (Kendall's compound F), which are biologically active with respect to liver glycogen deposition in adrenalectomized animals (*1*).

Incubation of 11-desoxy-17-hydroxycorticosterone (Reichstein's compound S) with certain microorganisms leads to the introduction of a hydroxyl group in the C-11 position, but in the unnatural alpha configuration (*2*). It is also possible to synthesize this unnatural isomer by chemical means (*3*). This differs from Kendall's compound F only by the stereoisomerism at the 11 position and the compound is commonly designated as epi-F.

The antagonistic action of structural analogs to naturally occurring compounds is now so well known as to constitute one of the basic areas of biochemistry (*4*). It has been demonstrated that the presence of oxygen on the 11 carbon of the active adrenal corticosteroids is important in the influence of these compounds on carbohydrate metabolism. It seemed attractive to conceive of the compound with the unnatural configuration at C-11 as a possible antagonist to the carbohydrate activity of the natural compound.

Accordingly, an experiment was designed to test this possibility. Compound F, epi-F, and mixtures were administered to adrenalectomized mice and the glycogenic activity was determined according to the method of Venning, Kazmin, and Bell (*5*). Young adult male mice, CBA × C57 BLK, F_1 hybrids, were used. Seventy milligrams of glucose were administered to each animal. The results are presented in Table 1.

The expected substantial deposition of glycogen was obtained with compound F. Limited glycogen deposition was seen with epi-F. Neither of the levels of epi-F employed had any apparent effect on the glycogen deposition obtained with compound F.

From these experiments it seems apparent that in the ratios employed, epi-F has no effect on the glycogenic property of compound F.

TABLE 1

LIVER GLYCOGEN DEPOSITION IN ADRENALECTOMIZED MICE

Steroid administered	Mg glycogen / 10 g mouse (range)	No. of animals
Control	0.2 (0.1–0.8)	10
20 γ compound F	6.4 (3.1–9.5)	10
500 γ epi-F	0.5 (0.1–2.1)	10
100 γ epi-F	1.3 (0.0–3.4)	9
20 γ compound F + 500 γ epi-F	5.7 (3.1–8.4)	10
20 γ compound F + 100 γ epi-F	7.2 (4.6–9.2)	10

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Book Reviews

An Appraisal of Anthropology Today. International Symposium on Anthropology of the Wenner-Gren Foundation. Sol Tax, Loren C. Eiseley, Irving Rouse, and Carl F. Voegelin, Eds. Chicago: Univ. Chicago Press; London: Cambridge Univ. Press, 1953. 395 pp. $6.00.

In 1952 the Wenner-Gren Foundation sponsored a conference of anthropologists for the purpose of writing and talking about the contemporary state of the science. A committee headed by A. L. Kroeber selected the participants. The written papers have been published as *Anthropology Today* (edited by Kroeber); the verbatim, tape-recorded discussions are available in the volume reviewed here.

The *Appraisal* consists of discussions centering upon the papers; consequently it cannot be read profitably without first reading the other volume. The discussions are organized on an analytical plan which makes sense for an integrated work but which in a transcript of discussions makes for confusion. Conversations on physical anthropology, for example, are found in six different chapters. The book has an index, but this does not help the reader to find his way through pages of talk to reach unexpected and important gems.

What can be learned about anthropology from this book? First of all, empirical richness and variety of data. Second, frank statements of varying schools of thought. Third, important deficiencies: a lack of conceptual integration, poor communication, and a tendency to harp on problems which anthropologists have delayed solving for years because of their failure to devise or learn appropriate concepts and methods.

Although most of the accurate critical strictures possible to make of modern anthropology have been voiced in this book, too many of them show that the speaker (and his listeners) do not comprehend the fact that such deficiencies have been apparent for years to outsiders. Thus one anthropologist notes, with an air of discovery, that the study of larger societies

requires analytical tools different from those used in studying small societies. And another perceives that "lip service" has been given to the so-called "integration" of anthropology which has in fact been absent—but hardly a single voice speaks up for the obvious solution: explorations toward an analytical conceptual scheme along multidimensional or "interdisciplinary" lines. Thus, although this volume and its companion book show that much empirical progress has been made, they also show that anthropology remains pretty much where Dr. Straus places it on page 153: "I do not think that anthropology exists as a distinct entity. . . . It exists merely as a meeting ground of people interested in man." Dr. Linton acknowledges this on the following page, but also wants anthropology to be a "real focal point of research." This goal can be realized only in part, as long as anthropology ignores its needs for conceptual precision, and fails to capitalize on its dependence on the often more sophisticated outlook of neighboring disciplines.

In the midst of applause for the Wenner-Gren conference, the reviewer offers a few dissenting observations. Science is made by men—particularly the social sciences where the operational character of the problem is often not as influential as the sheer productivity and persuasiveness of the scientists. Consequently one cannot hope to produce a genuine *summa anthropologica* on the basis of a selection of individuals. These individuals represent points of view, not slices of knowledge; the selection must inevitably be biased, and important voices must be left out. There is a slightly false note about a conference which proposes to examine the total condition of a field as diffuse and conceptually unintegrated as anthropology, and one must have certain reservations about its possible authoritarian influence and use. I do not believe that this is "anthropology today" and that the volume under review is a complete "appraisal."

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International Tables for X-ray Crystallography: Symmetry Groups, Vol. I. Norman F. M. Henry and Kathleen Lonsdale, Eds. Birmingham, Eng.: Kynoch Press, 1952. (For the International Union of Crystallography.) 558 pp. Illus. 105s.

This volume, together with two more that are to follow, will constitute a thoroughly revised and expanded edition of the *Internationale Tabellen zur Bestimmung von Kristallstrukturen* of 1935 (Borntraeger, Berlin), which were reprinted with corrections and notes in 1944 (Edwards Bros., Ann Arbor, Mich.). Many changes have been made, mostly for the better, so that the new tables indeed deserve a new name. The one chosen is unfortunately somewhat misleading, as most of the results compiled in this volume antedate x-ray diffraction. The new title is also unduly restrictive, for this work should prove of interest to *all* crystallographers, be they engaged in "electron crystallography," in "neutron crystallography," or even in "visible light crystallography." Many mathematicians, physicists, chemists, ceramicists, mineralogists, and metallurgists will find it useful.

After an unexpected historical introduction by M. von Laue—a pleasant surprise—this volume presents symmetry data for various kinds of groups (in 1, 2, and 3 dimensions); translation groups (1 row, 5 nets, 14 lattices); point groups (2, 10, 32); space groups (2, 17, 230). Subgroups and supergroups are tabulated for all point groups, for the 17 plane groups, and, as an example, for the space groups of one point group ($422\text{-}D_4$). The point-group symmetries of various physical properties of crystals are listed. Aspects symbols are tabulated and directions given for transforming them into diffraction symbols. The geometrical structure factors are listed not only for the general case but also for indices that obey certain criteria; they are collected in a separate section, in which the expression of the electron density is also given for each space group. Some, but not all, $|F(hkl)|$ and $\alpha(hkl)$ relationships are stated. The Delaunay reduction of any primitive cell to the conventional Bravais cell is included. Patterson-Harker functions, some statistical methods, and inequalities are also mentioned. In tables of concordance for space group symbols in alternate settings, interleaving symmetry planes are explicitly labeled; e.g., $I\,\underset{c}{b}\,\underset{c}{a}\,\underset{n}{m}$.

The editors have succeeded in limiting their selection to data of proved value. Half the book is devoted to space groups: symmetry diagrams, lists of positions of various multiplicities, coordinates of all sites in each position, reflection criteria. Each group begins a new page. Although the Hermann Mauguin notation is now given priority, the groups are still listed in the disorder of the Schoenflies superscripts. Some welcome simplifications: the tetragonal C and F settings have been dropped, and so has the hexagonal H setting. The primitive hexagonal lattice is no longer designated C but P. Rhombohedral diagrams are considerably improved. A defeatist decision to do away with all cubic diagrams undisputably results in compactness and economy. Alternative monoclinic descriptions, of dubious usefulness, require the consecration of the symbols that C. Hermann had relegated to a footnote in the 1935 *Tabellen*; e.g., *Pm* becomes *P*1*m* in the so-called "1st setting" and *P*1*m*1 in the standard (or "2nd") setting. The 1's used as fill-in do *not* refer to symmetry directions of the lattice, as they do in such symbols as *P*3*m*1 and *P*31*m*, so that this extension of the symbolism is rather infelicitous. Friedel's nomenclature of crystal classes is misquoted, as the alternate names provided for the trigonal classes when the lattice is hexagonal are left out. In places the text reads like a textbook, a mildly annoying feature in a book whose purpose is less to educate crystallographers than to make mathematical results accessible to them. The 1935 *Tabellen* were

trilingual; the new *Tables* speak only English. A 4-page "dictionary" translates technical terms into French, German, Russian, and Spanish. It is good as far as it goes, despite one or two fanciful translations. The material presentation of text, tables, and figures is lavish—no pain has been spared (no paper either).

The editors and their friends have worked hard at a labor of love. "You cannot please everybody and his uncle"—this *is* a job well done.

J. D. H. DONNAY
GABRIELLE DONNAY

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Proceedings of the International Congress on Analytical Chemistry, Oxford, England, September 4–9, 1952. Under the patronage of The International Union of Pure and Applied Chemistry. Cambridge, Eng.: W. Heffer, 1953. 493 pp. Illus. + plates. 42s.

At the meeting of the International Union of Pure and Applied Chemistry in New York in 1951, the Section of Analytical Chemistry officially came into being. Several years of preliminary planning then culminated in the meeting of the first International Congress on Analytical Chemistry held at Oxford University. A general report of the meeting, including the scientific papers presented, make up this book.

There are certain items of general interest such as the following: a foreword by Sir Robert Robinson; a list of the Union analytical commissions and sub-commissions, including the members; a list of the 87 analytical exhibits staged in the Dyson Perrins Laboratory during the meeting; and a list of the names of those attending the meeting.

The all-invited program of papers consisted of four general "congress lectures" by R. H. Müller, L. H. Lampitt, C. J. van Nieuwenburg, and I. M. Kolthoff, and 48 others on specific subjects. The latter are grouped under microchemical methods, biological methods, electrical methods, optical methods, radiochemical methods, organic complexes, presentation of data, adsorption and partition methods, and general. Each specific paper has an abstract in English, German, and French, together with a record of the subsequent discussion. All the papers appeared in the November and December 1952 issues of the *Analyst*.

The committee in charge of the program and the editor of the *Analyst* are to be congratulated on a very successful undertaking. The meeting will long be remembered by those in attendance.

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Scientific Book Register

Natural History of Infectious Disease. 2nd ed. of *Biological Aspects of Infectious Disease.* F. M. Burnet. New York: Cambridge Univ. Press, 1953. 356 pp. Illus. $4.50.

Aluminum in Iron and Steel. Samuel L. Case and Kent R. Van Horn. New York: Wiley; London: Chapman & Hall, 1953. (For the Engineering Foundation.) 478 pp. Illus. $8.50.

Statistical Methods in Experimentation: An Introduction. Oliver L. Lacey. New York: Macmillan, 1953. 249 pp. Illus. $4.50.

Fundamentals of Biology. M. J. Harbaugh and A. L. Goodrich, Eds. New York: Blakiston, 1953. 611 pp. Illus. $6.00.

Tensor Calculus. Barry Spain. Edinburgh–London: Oliver and Boyd; New York: Interscience, 1953. 125 pp. $1.55.

Chemical Physiology of Contraction in Body and Heart Muscle. A. Szent-Györgyi. New York: Academic Press, 1953. 135 pp. Illus. $4.80.

Electron Optics. 2nd ed. O. Klemperer. New York: Cambridge Univ. Press, 1953. 471 pp. Illus. $9.50.

Microbiology and Human Progress. Madeleine Parker Grant. New York: Rinehart, 1953. 718 pp. Illus. $6.75.

Introduction to Solid State Physics. Charles Kittel. New York: Wiley; London: Chapman & Hall, 1953. 396 pp. Illus. $7.00.

The End of the World: A Scientific Inquiry. Kenneth Heuer. New York–Toronto: Rinehart, 1953. 220 pp. + plates. $3.00.

The Philosophy of Human Nature. George P. Klubertanz. New York: Appleton-Century-Crofts, 1953. 444 pp. $3.50.

Radiations and Living Cells. An introduction to radiation biology, in which the action of penetrating radiations on the living cell is described, with special reference to the effect on cell division in human tissues. F. G. Spear. New York: Wiley, 1953. 222 pp. Illus. $3.50.

Adventures in Artificial Respiration. Peter V. Karpovich. New York: Association Press, 1953. 303 pp. Illus. $7.50.

The Good Doctor. And other selections from the essays and addresses of William de Berniere MacNider. William W. McLendon and Shirley Graves Cochrane, Eds. Chapel Hill: Univ. North Carolina Press, 1953. 179 pp. $5.00.

The Yields of a Crop. Based on an analysis of cotton-growing by irrigation in Egypt. W. Lawrence Balls. London: E. & F. N. Spon, 1953. 144 pp. Illus. + plates + charts. 21s.

Scientific Explanation. A study of the function of theory, probability and law in science; based upon the Tarner Lectures, 1946. Richard Bevan Braithwaite. New York: Cambridge Univ. Press. 1953. 376 pp. Illus. $8.00.

Chemical Constitution. An Introduction to the theory of the chemical bond. 1st Eng. ed. J. A. A. Ketelaar; trans. by L. C. Jackson. Amsterdam–Houston: Elsevier Press, 1953. 398 pp. Illus. $6.50.

Contact Dermatitis. George L. Waldbott. Springfield, Ill.: Thomas, 1953. 218 pp. Illus. $8.75.

Association Affairs

The Boston Meetings of the Association: A Bit of Background

Raymond L. Taylor

Associate Administrative Secretary

THE 120th Meeting of the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, the annual meeting for the year 1953, is also, officially, the Seventh Boston Meeting. The AAAS was conceived in Boston 106 years ago and, in some respects, this can be considered the ninth meeting in Boston and the tenth on the banks of the Charles—since the precursor of the Association met twice in that city and the young AAAS held its second meeting in Cambridge, in 1849. This year's gathering of scientists, industrial leaders, administrators, educators, engineers, and other science-minded professional people from all over the continent will come together for a common purpose suggested by the theme: "Scientific Resources for Freedom." In the final week of the year, it will be time once more to take stock both of current scientific research and of the problems that confront all scientists. Particular attention will be given to the nation's resources of scientific men, materials, and methods.

In meeting in Boston, again, the Association is returning to the city where its founding was planned and authorized, on September 24, 1847. It was at the eighth and terminal meeting of the Association of American Geologists and Naturalists on this date, more than a century ago, that the decision was made to reorganize the society as an enlarged American Association for the Promotion of Science. The chairman of the society at that time was William Barton Rogers (1804–1882), professor of geology and natural history in the University of Virginia, who, later, was to select Boston in which to found the Massachusetts Institute of Technology and to serve as its first president. When the new organization, renamed the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, met in Philadelphia, September 20, 1848, a special resolution was passed that Professor Rogers, last president of the AAGN, henceforth should be recognized as the first president of the AAAS, and, in fact, he presided until his elected successor, William C. Redfield of New York, took office.

The AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE has other links with Boston and the Commonwealth of Massachusetts, from which, in 1874, it received its charter of incorporation. In 1837, John Collins Warren of Boston read a paper before the British Association for the Advancement of Science and was so impressed with the value of one large meeting devoted to all the sciences that, upon his return the following year, he began the active promotion of a parallel organization in America. He, too, was present at the September 1847 meeting when the AAGN was reorganized. Since the British Association for the Advancement of Science, founded in 1831, is the prototype of the AAAS and of all similar associations for the advancement of science subsequently established throughout the world, it is particularly appropriate that a recent past president of the British Association, Dr. A. V. Hill, will deliver an address at this Seventh Boston Meeting.

The official First Boston Meeting of the AAAS, held in August, 1880, at Massachusetts Institute of Technology, then located between Copley Square and the Public Gardens, was an occasion, scientific and social, long to be remembered. Lewis H. Morgan, the renowned anthropologist, was president of the Association, which then had 1,555 members. The address of the retiring president, George F. Barker, an outstanding chemist of the period, was on "Some Modern Aspects of the Life-Question." There were 979 registrants from more than 30 states, Canada, England, and Cuba, and 276 papers were read. As first past president of the Association and also as first president and founder of M.I.T., the host institution, it was eminently fitting that William Barton Rogers, though now 76 years of age, should serve as General Chairman and deliver an address of welcome. The local "Committee at Large" included Charles Francis Adams, Charles W. Eliot, Ralph Waldo Emerson, Asa Gray, Oliver Wendell Holmes, Henry W. Longfellow, Francis Parkman, and Josiah Quincy—to name but a few. Samuel H. Scudder and Edward Burgess were secretaries.

In this more leisurely, less complicated period, M.I.T. served complimentary lunches daily. The President and Fellows of Harvard University entertained the entire attendance at dinner in Memorial Hall. There were receptions, notably those by President and Mrs. Rogers, Mr. and Mrs. Alexander Graham Bell, Mr. and Mrs. S. Endicott Peabody, and many open houses—including those sponsored by the Athenaeum, the Boston Society of Natural History, the Massachusetts Historical Society, and the Massachusetts Horticultural Society—and the City of Boston provided an excursion boat trip down the harbor complete with a collation. To facilitate reaching the sessions from the downtown hotels, "those cars passing by the Institute [were] designated by a white flag, with the letters A.A.A.S. . . ." The Western Union Telegraph Company and the American Bell Telephone Company transmitted the messages of the delegates gratis, the Post Office arranged to be open on Sunday morning, and the railroads not only had special rates for general convention travel but operated free trains to the White Mountains.

The Fiftieth Anniversary of the Association was celebrated at the Second Boston Meeting of August, 1897, with another distinguished anthropologist, Fred-

eric W. Putnam, who had served the AAAS as permanent secretary for 25 years, now the president. M.I.T. again was the host institution. The Copley Square Hotel was AAAS headquarters—with single rooms at $1.00 to $2.50. The address of Wolcott Gibbs, retiring president, and one of five surviving founders of the Association, was "On Some Points in Theoretical Chemistry." The Honorary President, Governor Roger Wolcott, took a personal interest in this meeting and delivered an excellent address. The papers read totaled 443 and the registration was 903.

By the time of the Third Boston Meeting, in 1909, once more on the former campus of M.I.T., the Association had changed its time of meeting from summer to the last week of December (primarily, because of the development of summer sessions on campuses), and the pattern of participation by a large number of scientific societies was well established. David Starr Jordan, eminent zoologist and university president, was president of the Association; the retiring presidential address, "A Geologic Forecast of the Future Opportunities of Our Race," was given by Thomas C. Chamberlin. Harry W. Tyler was General Chairman. There were 1,140 registrants, making this the largest AAAS meeting up to that time. Among the 404 papers read was "The Chemist's Place in Industry" by Arthur D. Little, founder of the firm which bears his name today. A national Bureau of Mines was recommended by the AAAS.

The Fourth Boston Meeting of December, 1922, with the celebrated Canadian anatomist, J. Playfair McMurrich, as president, was held principally on the new campus of M.I.T. though, as on previous occasions, there were events at Harvard University in Cambridge. The address of retiring president Eliakim H. Moore was "What Is a Number System?" Professor Samuel C. Prescott of M.I.T. was General Chairman. The Somerset was AAAS headquarters hotel. The exhibits, arranged for by a committee headed by Robert P. Bigelow, for the first time included a number installed by commercial exhibitors. It is gratifying to note that some of these pioneer exhibitors not only are still in business but will participate in this year's Exposition. The first of the annual addresses of the Society of the Sigma Xi at AAAS meetings was given by President Livingston Farrand of Cornell University on "The Nation and Its Health." The papers read totaled 1,019 and the registration was 2,339.

All local institutions of higher learning were hosts of the Fifth Boston Meeting of December, 1933. Sessions were held, principally, at Harvard, M.I.T., and at the Hotel Statler, AAAS headquarters. The exhibits, now the responsibility of a staff member, were in Harvard's Memorial Hall and, in number, exceeded those of all previous Expositions. It was a large and successful meeting despite the extremely low temperatures experienced by the entire East during this exceptional winter. The famous astronomer, Henry Norris Russell, was president of the Association, and presided at the address of the retiring president, John Jacob Abel, eminent pharmacologist, on "Poisons and Disease." Again, Samuel C. Prescott served as General Chairman; A. Lawrence Lowell was Honorary Chairman. A much appreciated event was a complimentary testimonial concert given by the Boston Symphony Orchestra with Dr. Serge Koussevitsky conducting. The eleventh winner of the AAAS Thousand Dollar Prize was Reuben L. Kahn for the paper, "Tissue Reactions in Immunity," in the program of Section N. About 1,500 papers were read and there were 2,351 registrants, as usual from nearly every state and Canadian province.

Though, again, all local institutions were hosts of the Association, the Sixth Boston Meeting of December, 1946, was characterized by a much more intensive use of downtown hotels for session rooms. The Annual Science Exposition was located in the Cadet Armory near the Hotel Statler, AAAS headquarters. President of the Association was James B. Conant; the retiring president, Charles F. Kettering, gave his address, "A Look at the Future of Science," in Symphony Hall. David M. Little of Harvard University was General Chairman. The twentieth winner of the AAAS Thousand Dollar Prize was shared equally by T. M. Sonneborn, Ruth V. Dippell, and Winifred Jacobson for several papers on the mechanism of heredity in *Paramecium,* read before the American Society of Zoologists; and by Quentin M. Geiman and Ralph W. McKee for "Cultural Studies on the Nutrition of Malarial Parasites," read before the American Society of Parasitologists. A total of 2,736 persons registered and 1,332 papers were read. The first AAAS-George Westinghouse Science Writing Award was won by James G. Chesnutt of the San Francisco *Call-Bulletin* for a story on a bubonic plague preventive.

In summary, the records of all previous meetings in Boston do not fail to mention the warm spirit of hospitality and interest in the Association and its work shown by the people of this cultural center. The group of cities and suburban communities which comprise the Boston Metropolitan Area—now with a population of two and one-half millions—has one of the country's greatest concentrations of institutions of higher learning, and of libraries, museums, and scientific laboratories. New England is compact and New York is nearby, so that local and regional attendance added to the several thousand persons who will come from all parts of the continent to attend the programs of the Association's 18 sections and subsections, and the national meetings of the zoologists, geneticists, science teachers, meteorologists, the History of Science Society, and others, may make the Seventh Boston Meeting the second largest in the annals of the Association. In all, in national and regional meetings and cosponsored sessions, some 57 organizations will participate. With sessions for contributed papers, symposia, distinguished evening addresses, and a growing number of conferences, the Seventh Boston Meeting will be one of the most significant annual conventions in the long history of the Association. Of

the 15 past presidents of the Association now living, five are residents of New England. It is hoped that they—Karl T. Compton, James B. Conant, Harlow Shapley, Edmund W. Sinnott, and Kirtley F. Mather[1] —and the others will be able to attend this year's meeting.

With its many historical landmarks, Boston itself is worth a visit at any time. Indeed, the "Points of Interest" are too numerous to describe in this year's General Program-Directory. Instead, each registrant will receive a complimentary printed handbook at the Main Registration–Information Center in the Mechanics Building. Founded in 1630, since colonial times, Boston has been a seaport, the banking and commercial metropolis of New England, and a great industrial center. In recent years, this city has become noted as as the site of new and important developments in chemistry, electronics, and nuclear physics. Many of these new "scientific resources for freedom" will be on display in the 160-booth Annual Exposition of Science and Industry in Mechanics Building. It is particular fitting that the General Chairman of this year's 120th AAAS meeting is Earl P. Stevenson, president of Arthur D. Little, Inc. Not only is he the leader of a company that has pioneered in the organized applications of science, but he is active in a number of national scientific organizations. His committees—the many persons who are working to make the Seventh Boston Meeting an unqualified success—will be listed later. The fruits of their contributions of time and thought will be apparent to those who attend this year's meeting.

The AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE continues to grow, both in personal membership and in affiliated professional societies and academies of science. In just the seven years since the Sixth Boston Meeting, the AAAS, now with a membership of aproximately 50,000, has experienced a net gain of more than 21,000 members. In 1946 there were 200 affiliates and associates; at this time, the number of affiliated and associated organizations is nearly 250. The Association's capacity for service to science, to scientists, and to society has been correspondingly enhanced. Fundamentally, the Association *is* its membership. Those who attend the Seventh Boston Meeting will do much to help chart its future course.

[1] The other ten living past presidents are Liberty Hyde Bailey, Robert A. Millikan, Henry Norris Russell, Albert F. Blakeslee, Irving Langmuir, Arthur H. Compton, Anton J. Carlson, Charles F. Kettering, Elvin C. Stakman, and Roger Adams.

Montana and Wyoming Join the Western Divisions

As a result of requests from members in the states of Montana and Wyoming, the question of the incorporation of these states in the Southwestern and Pacific Divisions of the Association was given careful study by the administrative office. A poll of the members was taken to determine their preferences. Of the 76 replies received, 69 favored affiliation with one of the Divisions. Wyoming voted 24 to 1 for the Southwestern Division. The Montana vote was a tie with a majority in the eastern part of the state favoring the Southwestern Division and a majority of those in the west expressing a preference for the Pacific Division.

The Executive Committee of the AAAS at its meeting December 26–29, 1952, authorized the administrative officers to work out an acceptable distribution of Montana between the Divisions and approved the incorporation of Wyoming into the Southwestern Division. By action of the Executive Committees and Councils of the two Divisions (the Southwestern Division at Tempe, Arizona, April 22, 1953, and the Pacific Division at Santa Barbara, California, June 19, 1953), Wyoming and Montana east of the Continental Divide were made a part of the Southwestern Division and Montana west of the Divide was formally accepted as part of the Pacific Division.

Bozeman, Billings, Great Falls, and Helena are the major Montana membership centers which now become part of the Southwestern Division. Missoula, Hamilton, and Butte are now in the territory of the Pacific Division.

A New AAAS Emblem

THE Board of Directors of the Association has approved the design reproduced at the left as a symbol of identification with the AAAS. In the future, this design will appear on the symposium volumes and will be used for other appropriate purposes.

The Association will soon make available to its *members* lapel buttons and pins. (Keys will also be provided if a sufficient number of orders for them is received.) The size will be identical with the illustration. The scalloped border and the lettering will be in rolled gold, the background in blue enamel, and the torch in red enamel. The key, if provided, will have the basic design superimposed on a black enamel background with a second rolled gold border.

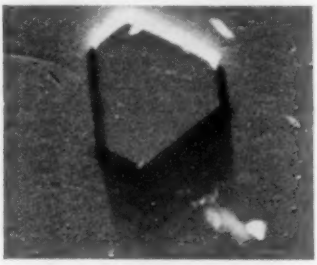
Information on prices and how to order insignia will be sent to all members and will appear in our journals in the fall.

Kodak reports to laboratories on:

selecting photographic plates for electron micrography... an old-fashioned organic brought up to date... an inexpensive team to take and show 8mm movies

Electron microscope

From work we've done with step wedges in the electron microscope emerge some reasonably plain facts that may be helpful in selecting photographic plates for electron mi-



crography. The wedges are made by successive gold-palladium shadowings of silver halide crystals with increasing obliquities, as pictured in the above electron micrograph.

The archaic-sounding *Kodak Lantern Slide Plates* still seem to be the best all-around bet for recording what the ultra-modern electron microscope reveals. They're inexpensive, they provide a wide range of sensitometric characteristics through choice of developer and development time, they're fine-grained, and we stock them in the usual sizes for the electron microscope. There are *Kodak Lantern Slide Plates, Medium* and *Kodak Lantern Slide Plates, Contrast*. We used to think that the latter gave slightly higher contrast in areas of low exposure, but we now must confess that whatever the differences between them to light exposure, to electron exposure they're pretty much alike. (The medium plate does have slightly finer grain.) The step-wedge project does, however, reveal some aces up our sleeve for the benefit of the electron micrographer with a special problem, viz.:

Kodak Spectroscopic Plates, Type III-O are much faster and have a more uniform density gradient over the exposure range, but have coarser grain than Kodak Lantern Slide Plates.

Kodak Spectroscopic Plates, Type IV-O are about three times as fast to electron exposure as Kodak Lantern Slide Plates and only slightly more grainy.

Kodak Spectroscopic Plates, Type V-O have a finer-grained but slower emulsion than Kodak Lantern Slide Plates.

Kodalith Ortho Plates, an all-or-none proposition we make principally for the photomechanical trades, should be resorted to by the electron micrographer only when in dire need of the highest attainable contrast.

Your Kodak Industrial Dealer handles all these plates. If you'd like a reprint of the paper that describes our step-wedge investigations, or if you need help in locating the right dealer, write Eastman Kodak Company, Industrial Photographic Sales Division, Rochester 4, N. Y.

The ant and the star

In the age of miracle drugs *Formic Acid*, simplest of carboxylic acids, appears in the *National Formulary*. As *Acidum Formicum*, it presumably possesses some old-fashioned pharmaceutical virtues as a counter-irritant and astringent. We sell it as Eastman 139, but not for this purpose at all. Although many Eastman Organic Chemicals *are* used in clinical investigation, we doubt that there is any great amount of such investigation in progress on *Formic Acid*. We suspect it is included in *N.F.* largely as a holdover from an older day when it was felt there must be medicinal value in a compound obtainable by so interesting a method as the distillation of ants.

The interesting thing about Eastman 139 for chemical purposes is the fact that it is considerably better than 98% *Formic Acid*. Most commercially available formic acid contains 10% of water. If you prefer it more anhydrous than that, then instead of seeking out a bulk supplier and persuading him to specially dehydrate a little of his formic acid for you, it's much simpler and quicker to put Eastman 139 down on your Eastman Organic Chemicals order. But, please, out of respect for the ★ that appears with each item in our catalog classed officially as a drug, append in good conscience the statement, "These chemicals will not be used for drug purposes or sold by us for such use."

Whether or not Formic Acid *is of immediate interest to you, you'll find over 3500 other highly purified Eastman Organic Chemicals in our "List No. 38." If you haven't a copy, write to Distillation Products Industries, Eastman Organic Chemicals Department, Rochester 3, N.Y. (Division of Eastman Kodak Company).*

Brownie team

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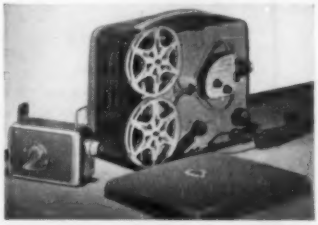

potential professional value, it's no sin to have a little fun with it once in a while.

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Publications Received

Carnegie Corporation of New York. Annual Report, 1952. New York: Carnegie Corporation, 1952. 82 pp.

Indian Central Jute Committee. Annual Report of the Jute Agricultural Research Institute (1951–52). Calcutta: Indian Central Jute Committee, 1953. 146 pp.

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Industrial Water Resources of Canada. Water Survey Report No. 4. ***Columbia River Drainage Basin in Canada, 1949–50.*** J. F. J. Thomas. Ottawa: Department of Mines and Technical Surveys, 1953. 80 pp. Illus. 75¢

Laboratory Experiments in General Chemistry and Semi-Microqualitative Analysis. George W. Watt and L. O. Morgan. New York: McGraw-Hill, 1953. 228 pp. $3.50.

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The Organization and Operation of Industrial Foundations in Texas. John W. Tippit. Research Report 43. College Station, Texas: Texas Engineering Experiment Station, 1953. iv + 16 pp. Illus.

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Reported Incidence of Selected Notifiable Diseases: United States, Each Division and State, 1920–50. Vital Statistics–Special Reports. Vol. 37, No. 9, National Summaries. Washington, D.C.: Dept. of Health, Education and Welfare, Public Health Service, 1953. 61 pp.

Reports to the U.S. Atomic Energy Commission on Nuclear Power Reactor Technology. Washington, D.C.: Government Printing Office, 1953. 88 pp. Illus. 25¢.

Review of Current Research and Directory of Member Institutions. State College, Pa.: Engineering College Research Council, 1953. 330 pp. $2.50.

Les Sensations Chez l'Animal. Collection "Que sais-je" No. 576. Ernest Baumgardt. Paris: Presses Universitaires de France, 1953. 124 pp. Illus.

Survey of Antimalarial Agents. Public Health Monograph No. 9. Washington, D.C.: Dept. of Health, Education and Welfare, Public Health Service, 1953. viii + 323 pp. $1.25.

Taschenbuch der Botanik. Bergründet von Hugo Miehe. Zweiter Teil. Systematik. 11, Verdäderte Auflage. Walter Mevius. Stuttgart: Georg Thieme, 1953. 180 pp. Illus. DM 8.90.

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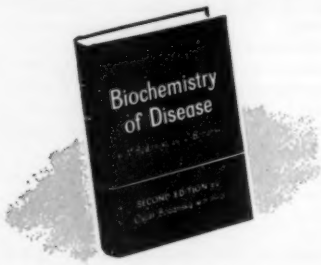

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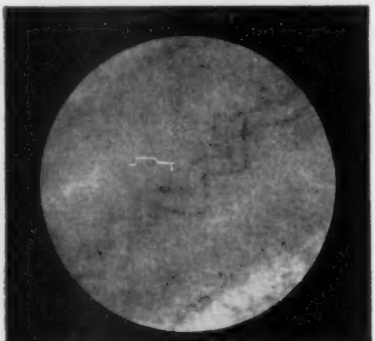

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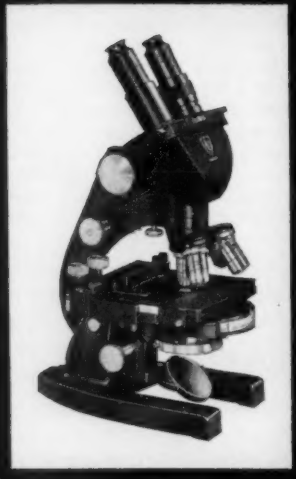

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